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Hydraulics & Pneumatics

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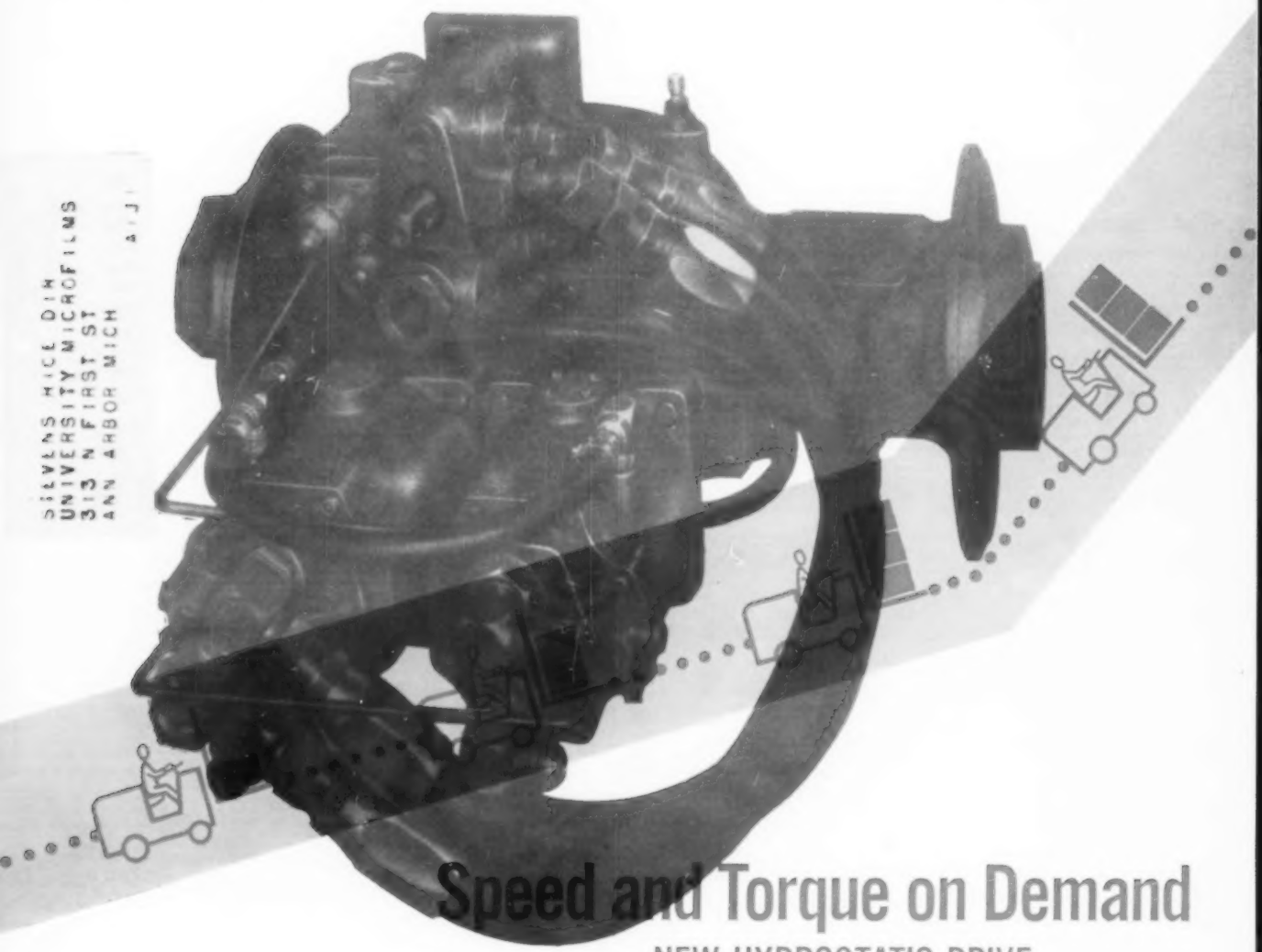

Speed and Torque on Demand

. . . NEW HYDROSTATIC DRIVE

see contents page 3

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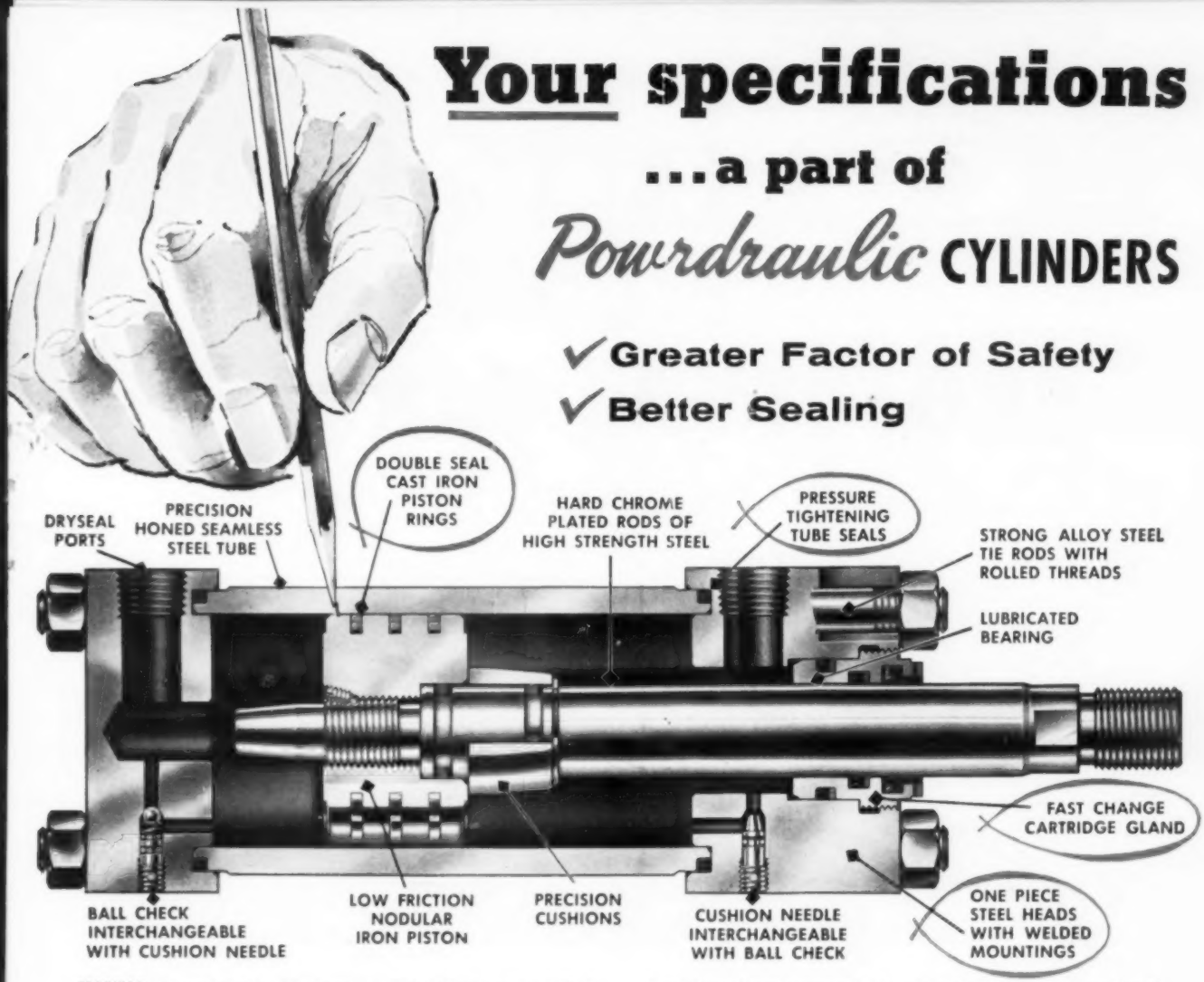
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PRECISION HONED SEAMLESS STEEL TUBE
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HARD CHROME PLATED RODS OF HIGH STRENGTH STEEL
PRESSURE TIGHTENING TUBE SEALS
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EXCLUSIVE PRESSURE TIGHTENING TUBE SEALS, located on the outside diameter of the cylinder tube, form a positive seal at all pressures from zero to maximum. Minute expansion of the tube due to pressure, squeezes the "O" ring making the seal even tighter. The "O" ring is fully confined between the head and the tube and will not extrude at high pressures. Unlike other cylinders that seal at the tube ends or inside diameter, the Hanna Powrdraulic Cylinder with pressure tightening O.D. seals will remain tight at all pressures.

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FAST CHANGE CARTRIDGE GLAND equipped with a leak proof, low friction rod seal forms a tight seal from zero to maximum pressure. Built in rod wiper removes dirt and particles from piston rod as the rod moves "in" and serves as another hydraulic seal to wipe the rod dry on the "out" stroke. You can select either the standard gland or the optional, multiple lip, spring loaded seal. The optional gland is interchangeable and is available with synthetic rubber or Teflon* Vee packing.

ONE PIECE STEEL HEADS WITH WELDED MOUNTINGS are much stronger than conventional bolted construction and assure squareness of mountings. All mountings are designed to carry maximum cylinder loads with a generous safety margin.

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*DuPont's registered trademark.

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Hydraulics & Pneumatics

MARCH 1959 VOLUME 12/NUMBER 3

THE MAGAZINE OF FLUID POWER

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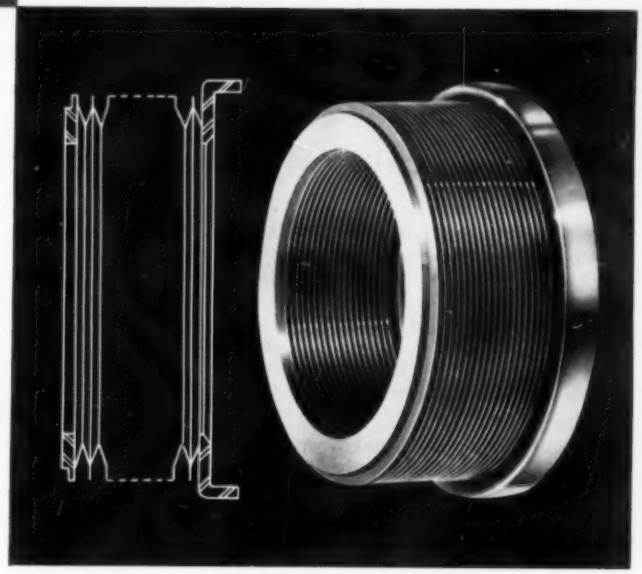
C/R DESIGN NOTES

How C/R's New Metal Bellows Seal Meets Seemingly Impossible Operating Conditions



Operating Ranges

Temperature	−400° to 1000° F.
Pressure	500 psi
R.P.M.	80,000 plus

These known operating ranges indicate the function of this seal. It is designed for applications where temperatures and mediums to be sealed forbid the use of any organic materials. Typically, these applications include fuel pumps, compressor power units and turbine starters characteristic in rockets and missiles. Other applications include mechanisms which are exposed to a high level of radioactivity.

Design Advantages

The C/R metal bellows seal consists of a metal bellows — a welded homogeneous unit which is secured at one end — and a carrier ring in which the sealing face is mounted. The seal does not contact the shaft. It is stationary, and the only rubbing surfaces are the sealing face and mating ring. These surfaces are precision lapped to provide a positive seal with minimum friction. At any given pressure, the seal can be designed to maintain proper and constantly effective face loads. It orients immediately to run-out and will resist any torques it is subjected to in operation. The design has high end-play tolerance: Chicago Rawhide engineers have deflected a bellows .100 in. for three million cycles at 1750 cpm and at a temperature of 500° F. with no adverse effects.

A further advantage is relatively light weight and compactness. The C/R metal bellows seal can be designed for minimum axial and radial space. Axially, complete seals can be produced within a ¼ in. cross-section. Radially, dimensions are comparable with conventional end face seals.

The C/R metal bellows seal can also be designed with an extremely low coefficient of expansion. The importance of this factor becomes apparent with the fact that in many applications the operating temperature may change hundreds of degrees in a very few seconds.

Mediums To Be Sealed

Virtually any known liquid or gas may be positively sealed with this design, depending upon duration or service life. From a practical viewpoint, the C/R metal bellows seal is the best design for the sealing of cryogenic and high-energy fuels such as LOX, hydrogen peroxide, fluorine and other missile and rocket propellants.

Where possible, lubrication of the two sealing faces is desirable to prolong service life. However, the medium being sealed commonly acts as the lubricant and may be merely hot gas.

Materials

Sealing faces and mating rings for the C/R metal bellows seal are available in a variety of materials including carbons, carbides, ceramics and various alloyed metals for both high temperature and corrosion resistance. The bellows can be furnished in any of several metals and alloys such as stainless steel, Monel, Inconel X, Ni-Span C and other special alloy steels.

Consult C/R Engineers

Each application for the C/R metal bellows seal is essentially a custom-design and an intimate knowledge of all conditions to be encountered must be known by Chicago Rawhide engineers to produce the correct combination of properties in the seal. Then, whether you require five, fifty or five thousand seals, Chicago Rawhide will design and produce the correct seal to solve your problem.

Helpful Design Data:

We will gladly furnish you with a design guide and space envelope data concerning the C/R Metal Bellows Seal. Just write for Bulletin MBS-1 on your company letterhead.

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NOTHING BUT THE BEST IN GAGES FOR WORKING PRESSURES FROM 30" VACUUM TO 10,000 p. s. i.

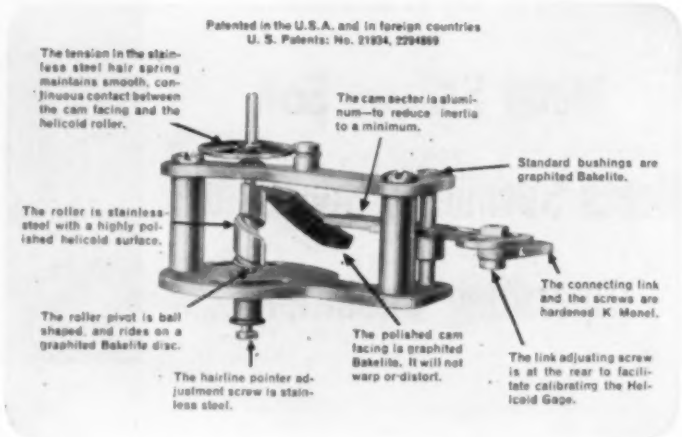
Shock-Proof Cam Actuation (no gears—no teeth) Makes Helicoid Gages Ideal for Hydraulic Services

Designed for pulsating and impact hydraulic service, the Helicoid movement releases at zero in the event of sudden pressure reduction. This eliminates shock on pointer and movement by reducing impact of pointer against pointer stop pin. This protects the gage mechanism where gages may be subject to occasional vacuum.

The superiority of Helicoid Gages is most evident in severe service—wherever a gage is subjected to violent pressure pulsations or certain severe mechanical vibrations.

The *sustained accuracy* of Helicoid Gages over *millions of cycles* is explained by the details of design and construction of the Helicoid movement shown at the right.

Rolling action of the cam facing against the roller surface . . . graphited Bakelite bushings, roller pivot base and cam facing . . . K Monel connecting links and screws . . . all such Helicoid features protect against wear and corrosion and assure sensitivity, sustained accuracy and trouble-free operation through millions of cycles.


Patented in the U.S.A. and in foreign countries
U. S. Patents: No. 21934, 2294859
The tension in the stainless steel hair spring maintains smooth, continuous contact between the cam facing and the helicoid roller.
The cam sector is aluminum—to reduce inertia to a minimum.
Standard bushings are graphited Bakelite.
The roller is stainless-steel with a highly polished helicoid surface.
The connecting link and the screws are hardened K Monel.
The roller pivot is ball shaped, and rides on a graphited Bakelite disc.
The polished cam facing is graphited Bakelite. It will not warp or distort.
The link adjusting screw is at the rear to facilitate calibrating the Helicoid Gage.
The hairline pointer adjustment screw is stainless steel.

HELICOID GAGE CARTRIDGE SNUBBER

(Patent pending)

Enlarged cutaway view

This is a simple, effective throttling device to reduce or eliminate pulsations of the gage pointer. There are no moving parts, no adjustments needed. Available in three types in powdered bronze or stainless steel for air, gas, water, steam, medium or heavy liquids.

Threaded cartridge body for assembly in any Helicoid Gage tapped socket shank

EASIEST ADJUSTMENT AND CALIBRATION

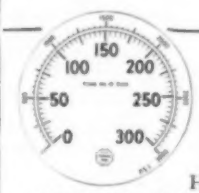
Only Helicoid Gages have the external pointer adjustment pictured here. The Helicoid type adjustment cannot be jarred out of position.

Calibration of Helicoid Gages is accomplished easily, without removing dial or pointer, because the link adjusting screw is at the rear of the system.

TUBES BUILT FOR MILLIONS OF PRESSURE PULSATIONS

To fit the wide range of applications, Helicoid Bourdon tubes are available in four materials—alloy steel, K Monel, stainless steel and phosphor bronze.

All Helicoid tubes are made from seamless tubing and are carefully designed to give maximum torque and minimum stress. When used within the dial range, they will withstand many millions of pressure pulsations and will not stretch, leak nor crack.



DOUBLE SCALE DIAL SHOWS TONS ON RAM AND PSI

Helicoid Gage dials are supplied in jet black with white figure markings or in dull white with black figure markings. They are constructed of laminated phenol with a transparent plastic surface and the longest possible scale length for more accurate readings. They are non-corroding, will not discolor nor fade and will not crack, chip nor peel.

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TRADE MARK

Helicoid gives you all these features at prices that are competitive in the quality gage field

. . . Fluid Power News

NO. 12,103
"HYTAC"* SYSTEMS ON NEW PAPER MACHINE

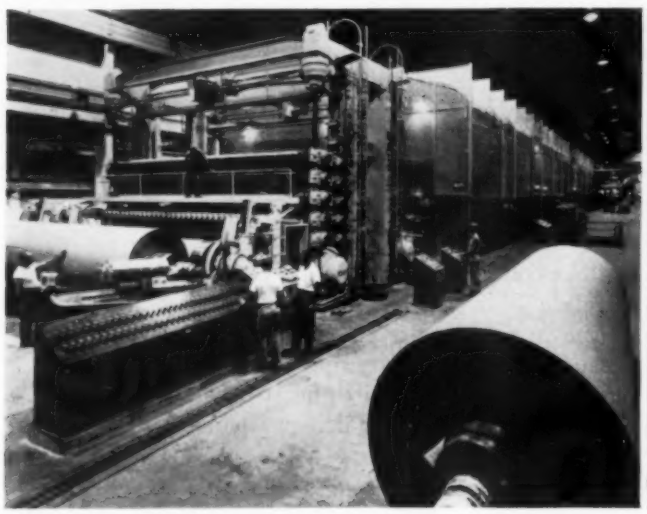
From Oilgear Application-Engineering Files

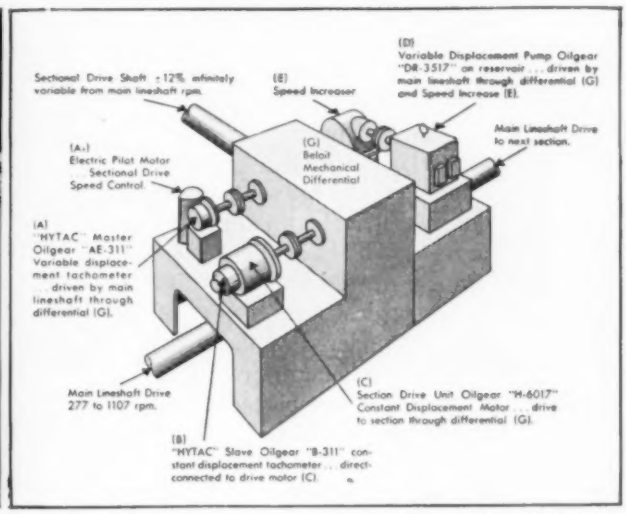
HOW OILGEAR *"ANY-SPEED"* DRIVES ON NEW PAPER MACHINE ACCURATELY CONTROL SECTION SPEEDS

USER: *West Virginia Pulp and Paper Company (Westvaco) (Builder—Beloit Iron Works, Beloit, Wisconsin)*

DATA: Systems to individually vary and accurately control speeds on four sections of a new, 264-in., $25,000,000 paper machine that will produce up to 225 tons daily of a revolutionary, patented, smooth, extensible kraft sheet. Machine is powered from a block-long main lineshaft with mechanical differentials at each section. Main lineshaft speed will vary over a 4:1 range—from 277 to 1107 rpm.

REQUIREMENTS: 1. A system that, when applied to each of four mechanical differentials, will provide individual, precision-controlled, infinitely variable increase or decrease of 10% over or under main lineshaft speed—as selected from 2 local, and 7 remote push-button stations. 2. Each system to maintain selected speed for its section within ±0.25% max. variation over a 50% load change at max. lineshaft speed. 3. Systems must also be: a. Compact. b. Impervious to moisture and daily high-pressure "wash-down." c. Thrifty on electrical power input. d. Trouble-free for continuous, heavy-duty, full-production paper machine drive service.




(D) Variable Displacement Pump Oilgear "DR-3517" on reservoir . . . driven by main lineshaft through differential (G) and Speed Increase (E).
Sectional Drive Shaft ±12% infinitely variable from main lineshaft rpm.
(E) Speed Increaser
Main Lineshaft Drive to next section.
(A1) Electric Pilot Motor Sectional Drive Speed Control.
(G) Beloit Mechanical Differential
(A) "HYTAC" Master Oilgear "AE-311" Variable displacement tachometer . . . driven by main lineshaft through differential (G).
Main Lineshaft Drive 277 to 1107 rpm.
(C) Section Drive Unit Oilgear "H-6017" Constant Displacement Motor . . . drive to section through differential (G).
(B) "HYTAC" Slave Oilgear "B-311" constant displacement tachometer . . . direct-connected to drive motor (C).

SOLUTION: *Application-Engineered* Oilgear *Hytac** (hydraulic tachometer) controlled drives provide precise, individual speed control on each of four sections—3rd dryer, 1st calender, 2nd calender, and winder reel of Westvaco's new #3 kraft machine shown above. Drawing, above right, shows components of typical sectional drive. *These highly accurate, compact, heavy-duty systems have met or exceeded all originally specified requirements.* Examples: 1. Specified ±10% infinitely variable sectional speed control range exceeded by providing ±12% in actual operation. 2. Selected speeds are maintained within specified limits *regardless* of load change. 3. Production speeds increased to over 2000 fpm. Important "Oilgear-plus" features are: 1. Dual winder control that, with the mere flip of a control panel switch, converts winder drive from speed-controlled to tension-controlled . . . speed control prevents tearing the tail strip when starting a new core, while tension control provides good roll quality at full sheet width. 2. Cushioned, controlled acceleration and deceleration. 3. Positive overload protection. 4. Pressure and flood lubrication with continuous power fluid filtration.

OPERATION: Fluid from master tach (A) gives section drive speed command to control on pump (D). Slave tach (B) feeds back a flow signal proportional to actual section drive speed. When main lineshaft speed is increased or decreased, fluid flow from master tach (A) automatically increases or decreases to command section drive to follow lineshaft speed change. Through local or remote pushbutton stations connected to electric pilot motor (A_1) on master tach (A), operator can increase or decrease speed of each *Hytac* section infinitely up to 12% of prevailing lineshaft speed.

A second Westvaco kraft machine will have an *Application-Engineered* Oilgear Controlled Motion System to cover a 10:1 lineshaft speed range, and a wider sectional speed range adjustment.

*"HYTAC" Systems—An Oilgear Trademark

Left: Oilgear Sectional Drive Pump (D) with integral reservoir. *Right:* Oilgear Sectional Drive Motor (C) with direct-connected *Hytac* slave (B) to left.

Fluid Power drives and controls were selected after three years of development on this process and machine—from a 2-in. table model, through a 15-in. laboratory model and 60-in. pilot model. Conventional variable speed drives could not provide the sectional speed control required. *"Equipped with the most advanced precision controls known to the industry . . ."*—is the statement Westvaco has made concerning their new #3 machine.

. . . for the lowest cost per year—it's Oilgear!

For similar practical solutions to YOUR linear or rotary Controlled-Motion problems, call the factory-trained Oilgear Application-Engineer in your vicinity. Or write, stating your specific requirements, directly to . . .

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FLUID POWER LINES

about hydraulics & pneumatics

NEW HYDROSTATIC DRIVE . . . Few areas in fluid power design present a more exciting frontier than hydrostatic drives. Constant torque throughout the speed range, inherent braking and overload protection, and simple speed control are some of the features that make this drive so attractive. Why haven't designers taken greater advantage of it? Component design problems and cost have hindered applications, but these are being overcome as the need for compactness and higher power increases.

A major development just announced, is Towmotor's new fork lift truck driven by pressure-compensated, variable displacement motors mounted at each rear wheel. A single foot pedal actuates the 6-way, 5-position valve which controls flow to the motors for fast travel or creep, either forward or backward. Sequence valving automatically puts the pressure-compensated motors into maximum displacement for high torque when the truck starts up an incline. The system described on page 67 is a refinement of an earlier development first reported by AH&P in December '56.

GETTING TOGETHER . . . If designers of 2-platen presses think they have problems of synchronizing cylinders, they'll feel better after reading *Equalize Press Closing...Hydraulically...Mechanically.* It tells about multi-platen presses. Not only must the platens stay level, they must all close at the same time. Many designs have been used; two of them are discussed in this article. See if it doesn't give you some ideas for designing telescopic cylinders.

HAWAII CALLING . . . It's easier to dial Waikiki now that a new telephone cable has been laid from San Francisco to Honolulu. Why are *we* interested in the project? Partly because we like to daydream about Hawaii, and partly because hydraulics figured prominently in the job. The cable pay-out system requires fine tension and speed control—a natural for variable delivery pumps.

JANUARY 1959 DESIGNERS' GUIDE ISSUE

Extra copies of the Fluid Power Specifications issue are available. 100 pages of charts give specifications and manufacturers for:

Accumulators	Filters	Air Motors
Actuators, Rotary Torque	Hose Fittings	Fluid Motors
Aftercoolers	Tube Fittings	Packings
Air Compressors	Hydraulic Fluids	Pumps
Oil Coolers	Pressure Gages	Pressure Switches
Cylinders	Joints	Hydraulic Valves
	Lubricators	Air Valves

Single copy price is $1.00; 75¢ each for 25 to 49 copies; 40¢ each for 50 or more copies.

BACK SEAT DRIVER . . . We think the day is coming when you'll switch on the autopilot in your car, swivel around, and deal a hand of bridge while racing across the countryside. All of this because of advances in aircraft autopilot design. To learn about three types of hydraulic autopilot servos, turn to the Aircraft Section on page 110.

SWEET KISSES FOR SWEET CHARITY
PRESS BOTH SIDE BUTTONS AT THE SAME TIME TO RAISE SEPARATING SCREEN
KISSES $1.00
KISSES $1.00

What? Air Polices the Hands Off Policy!

We are not serious, but—

The boys might forget that a kiss doesn't involve the hands but this circuit doesn't. The screen takes care of this. When both his hands depress the actuator buttons, they start the sequence to lift the screen, but "sneaking" one hand off calls for the screen to again guard Miss "Belle-of-the-Bazaar." Our society is pretty romantic so we doubt if this "automatic bolster" will ever become popular. But as a safety feature on presses, brakes and shears the Ross non-tie-down valve, designed to keep both the operator's hands occupied, should become popular.

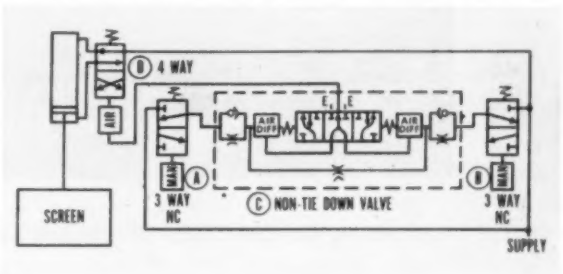
If you are interested in "two-hand safety" you are interested in a Ross non-tie-down valve.

If the operator follows instructions, then two three-way valves, either in series or in parallel, can protect his hands to a degree; but the *operator* who sets his mind to it, can beat either of these hook-ups and keep one hand free. This valve is designed to avoid one hand operation. In the Ross non-tie-down circuit, both three-way button valves are depressed at once to initiate an action and both released before another action can be initiated.

ROSS OPERATING VALVE CO.

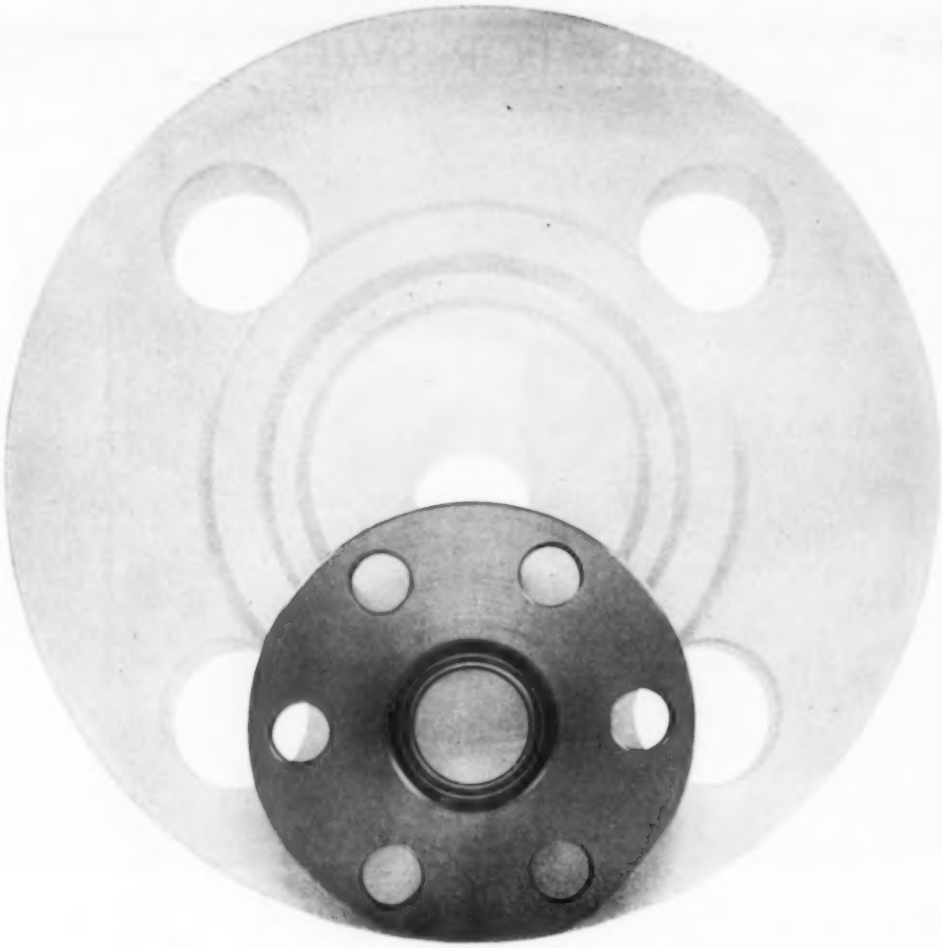
105 E. Golden Gate Ave. • Detroit 3, Michigan

The Ross non-tie-down valve is just one of the many designed by Ross to assist in creating safer press circuits. Call your nearby Ross engineer or write for full details.



SEQUENCE OF OPERATIONS

- Operating valves "A" and "B" simultaneously permits air to flow through the valve "C", shifting valve "D". Valve "D" operates cylinder raising screen.
- De-actuating valves "A" and "B" simultaneously de-actuates valves "C" and "D". Cylinder retracts and valve "C" re-sets itself for another cycle.
- Operating either valve "A" or "B" independently will *not* cause valve "C" to pass actuating air to valve "D".
- De-actuating either valve "A" or "B" independently, causes pilot air to valve "D" to be exhausted through valve "C". After that occurs both valves "A" and "B" must be released to re-set valve "C" before it will pass air to valve "D" again.



WE SHRUNK EVERYTHING...EXCEPT PERFORMANCE

Now you can save up to 50% in piping costs in high-pressure applications—with this new smaller and lighter flange

Now, for the first time, the long-standing problem of how to fit heavy and bulky flanges into the complex configurations of today's high-pressure piping systems has been solved. Equally important, this new stainless steel flange by Accessory Products actually handles pressures *equivalent* to those being handled by standard ASA flanges...*at a tremendous saving in cost!*

Available in line sizes from 1/4 inch through 2 inches, priced from $30 to $65—your choice of weld-neck, male pipe thread special high-pressure male adapters, and blind flanges. These flanges provide the ultimate in low-cost, compact, and reliable connectors for all high-pressure piping applications. For the complete story and specifications to meet your piping needs, write for Design Bulletin DB-159. Our engineers will be happy to discuss your specific applications.

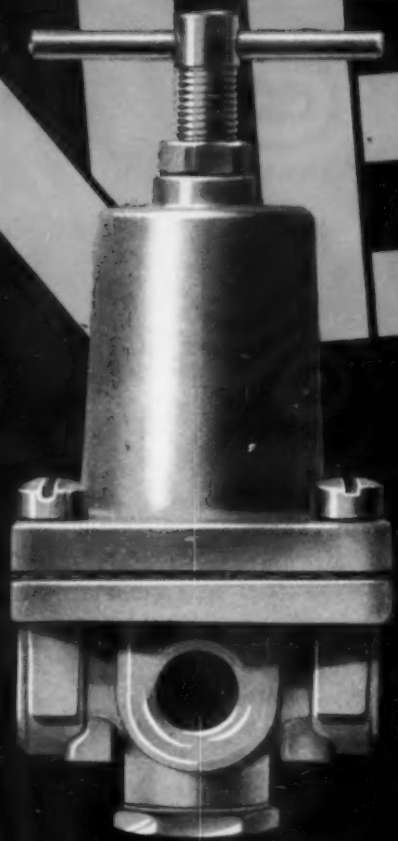
APCO **ACCESSORY PRODUCTS CORPORATION**

a division of textron corporation / 616 West Whittier Blvd., Whittier, Calif. Phone: OXford 3-3747

Circle **1** on Time-Saver Card

Circle **150** ➡

NEW



WATTS

Compact, general purpose

4-WAY AIR PRESSURE REGULATOR

Series 112
(Actual Size)

Designed for a wide range of low-cost OEM and plant applications

Extremely compact in design and low in cost, the new Watts Air Pressure Regulator meets a wide range of applications where larger, more expensive regulators have been used.

This new 4-way regulator is ruggedly constructed. Excellent flow capacity. Dependable. Ideal as an OEM component in competitively priced equipment such as air compressors and paint spray rigs, as well as in other applications where air pressure must remain constant for maximum operating efficiency.

Constructed of die-cast zinc, with internal parts of brass. Diaphragm and disc of oil-resistant Buna-N. Available in ¼" size only. Write for data sheet and complete information.

Series 113 is identical except for self-relieving feature which prevents pressure build-up in the reduced pressure system, and permits downward pressure adjustment without bleeding the line.

A COMPLETE RANGE OF RELIEVING AND NON-RELIEVING REGULATORS

Series 15, 16
SMALL
PRECISION TYPE

Series 115, 116
PRECISION
LOW PRESSURE TYPE

Series 18, 19
HIGH CAPACITY
TYPE

WATTS REGULATOR COMPANY *Industrial Division • 6 Embankment Road, Lawrence, Mass.*

"VITON"* COMPOUNDS SEAL AT NEW TEMPERATURE HIGHS

*Trademark of E.I. du Pont de Nemours & Co.

Bothered by seal failure, or packings breakdown because of high temperatures? IPC may have your answer.

A new fluorinated rubber, VITON*, now solves sealing problems with a temperature range from —65° to over 600° F. Carefully controlled, these IPC VITON* packings and seals eliminate the punishing effects of temperature.

Why not ask IPC for a survey of your particular problem. Experience is priceless and IPC has pioneered in the use of VITON* for high temperature applications.

Custom designed . . . for your application.

OIL SEALS
PACKINGS
PRECISION MOLDING

IPC

INTERNATIONAL PACKINGS CORPORATION

Bristol, New Hampshire

P2

DYNAMIC DIFFERENCE

in hydraulic performance

Webster

"HC" SERIES POSITIVE DISPLACEMENT GEAR-TYPE PUMP

Tough, tenacious . . . Terratrac! When this powerful diesel dozer flexes its hydraulic muscles, things *move!* Just a touch on the control lever triggers the action . . . a Webster "HC" pump follows up with a surge of oil power to handle big loads *fast.*

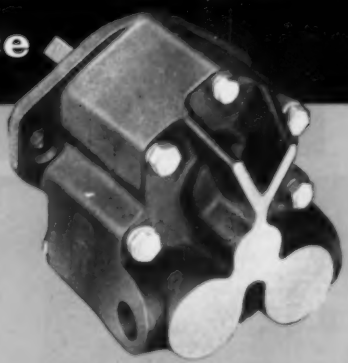
This is just one application of the big capacity "HC" series. There are many more. On all types of heavy industrial and road building equipment it powers demanding hydraulic jobs with speed, stamina and reserve.

And, there are additional reasons engineers specify the "HC" series . . . they're compact, adapt easily to the product and job, dependable. That's why when you figure on Webster, it adds up to *the dynamic difference that pays!*

OIL HYDRAULICS DIVISION

WEBSTER ELECTRIC

our 50th year RACINE · WIS



"HC" SERIES POSITIVE DISPLACEMENT GEAR-TYPE PUMP

Shaft seal: lip type
Drive: direct, gear or belt
Capacity: 5 sizes, 5 - 17 gpm
Pressure: to 1500 psi
Operating speeds: to 2400 rpm
Porting: side (Std.) end (Opt.)
Valve: optional, internal relief, adjustable 800 - 1500 psi

BULLETIN HY1 gives complete engineering characteristics — performance and installation data.

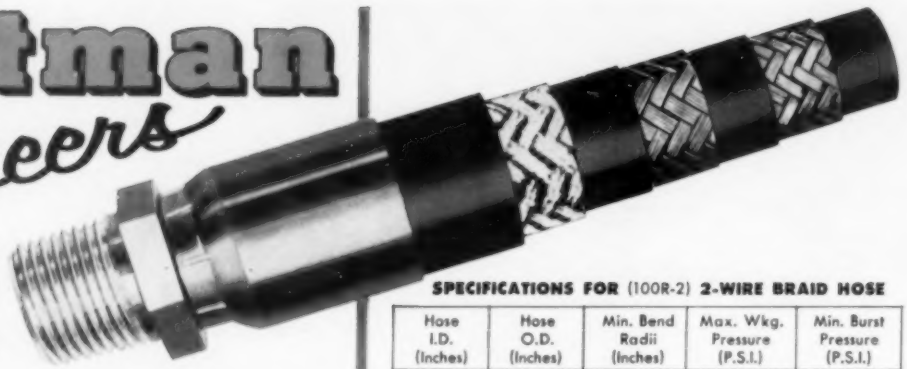
Call the man from Webster

. . . he's one of a staff of engineers specially trained in hydraulic application. He can help you solve special problems when hydraulics become a part of your design.

photo . . . courtesy J. I. Case Company, Racine, Wis.

Eastman

engineers the way



TO HIGHER PRESSURES

Eastman engineering is making possible ever-increasing advances in hydraulic pressures through:

- Couplings designed to exceed minimum *burst* pressure —four times actual working pressure.
- Hydraulic application of couplings to hose, assuring maximum grip—within specified hose tolerance.
- Maximum orifice—designed to improve fluid flow, reduce friction and increase power delivery.
- More rigid testing of completed assemblies to reveal additional opportunities for improvement.

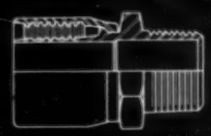
Let Eastman engineers help you increase the "power-performance ratio" of your product to improve your competitive position in your field.

SPECIFICATIONS FOR (100R-2) 2-WIRE BRAID HOSE

Hose I.D. (Inches)	Hose O.D. (Inches)	Min. Bend Radii (Inches)	Max. Wkg. Pressure (P.S.I.)	Min. Burst Pressure (P.S.I.)
¼	11/16	4	5000	20000
⅜	23/32	5	4000	16000
½	31/32	7	3500	14000
¾	1 ¼	9½	2250	9000
1	1 5/16	9½	1875	7500
1 ¼	2	16	1625	6500
1 ½	2 ¼	20	1250	5000
2	2 ¾	22	1125	4500

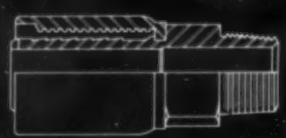
PERMANENTLY ATTACHED COUPLINGS

For 2-wire braid hose. Offers maximum coupling strength, strong hose attachment and improved orifice for rapid, friction-free fluid flow. For working pressures up to 5000 psi. See Pages 10 and 11.



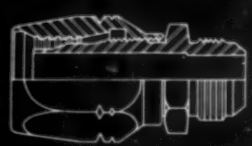
HIGH PRESSURE COUPLINGS

For EXTREME high pressures up to 7000 psi working pressure. Eastman engineered for greater power delivery and performance. For specifications and sizes, send for New Eastman Bulletin 200, below.



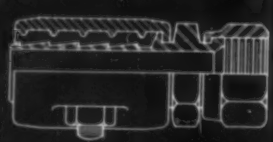
2-PIECE REUSABLE COUPLINGS

For 2-wire high pressure hose up to 5000 psi working pressure. Increases serviceability of your equipment through easy replacement in the field. See new Bulletin for complete details.



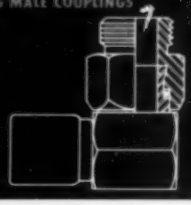
CLAMP TYPE COUPLINGS

Accurate machining assures alternate positioning of clamp ribs between each barb of insert—creating exclusive Inter-Lock grip—available to you only through Eastman. Pages 14 and 15.



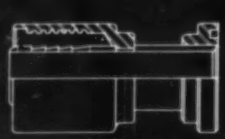
SWIVEL "O" RING MALE COUPLINGS

Permits easy assembly in close quarters, easy positioning of hose in 45° and 90° angles. Economical, reduces number of threaded connections. Dimensional drawings, sizes, and specifications in new Bulletin.



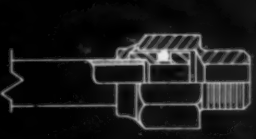
FLANGE HEAD COUPLINGS

Offer advantages of permanent hose attachment plus Split Flange Head Couplings with 0° to 90° stems. Economy plus user convenience. Specifications and sizes listed in new Bulletin.



TUBING ASSEMBLIES

Swivel Male "O" Ring Tube Nut used on tubing assemblies. Eastman offers formed tubing with beaded or flared ends—to your requirements. Specifications and sizes on Page 30.



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first in the field

MANUFACTURING COMPANY

Dept. AH-3, MANITOWOC, WISCONSIN

Write FOR YOUR NEW BOOK— WITH THAT NEW LOOK!

- A NEW Service Concept.
- A NEW High in Convenience.
- A NEW Ease in Specifying— according to **your** pressure requirements.

SAFEGUARDING AMERICA'S LIFELINES OF MOBILE POWER

LETTERS to the editor

Address your letters to: Editor, APPLIED HYDRAULICS & PNEUMATICS MAGAZINE, 812 Huron Rd., Cleveland 15, Ohio.

Surface Finish

TO THE EDITOR:

I have read with interest the article in the November issue of APPLIED HYDRAULICS & PNEUMATICS titled *Eliminate Trapped Oil to Increase Packing Life*, and agree with the points covered.

I feel, however, that with regard to surface finish of cylinder walls, a minimum finish of 12 micro inches could lead to breakdown of packing. Past experience has led me to believe that the ideal finish of cylinder walls should be 5 to 12 CLA micro inches. *(CLA is a British measurement that stands for center line average. It is generally 10 to 20 percent lower than the American RMS).*

K. R. TAYLOR
Oil Seal Division
Super Oil Seals & Gaskets Ltd.
Birmingham, England

Certainly the matter of surface finish, is one about which there is considerable debate. Practical experience is most helpful, and the viewpoints of our readers are always desirable.

Air Valves

TO THE EDITOR:

We would like your help in answering a question that has caused some discussion in our office. What is the accepted method of determining pressure drop in an air valve?

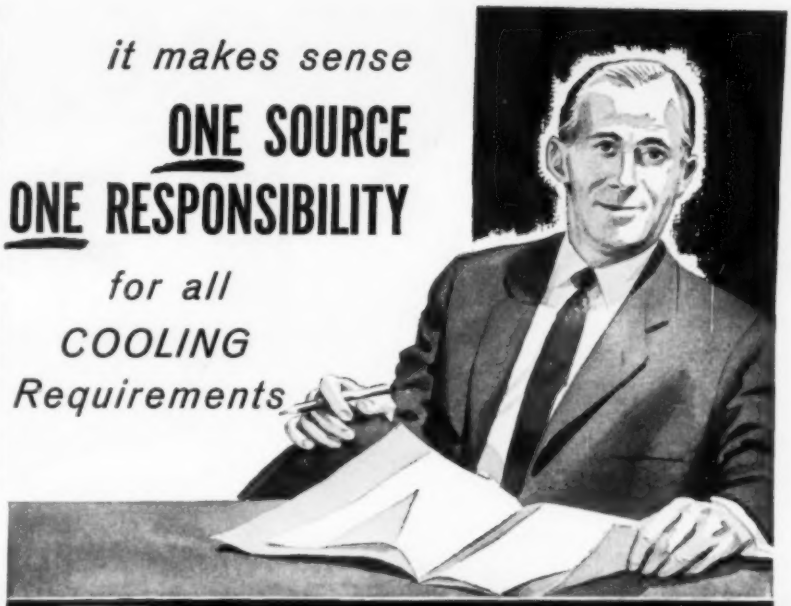
You might also advise us the ordinary way to calculate cycling speed.

JAMES E. MEAD
Mead Specialties Co.
Chicago, Ill.

We know of no standard method to determine pressure drop in an air valve. Undoubtedly, this data could be important in certain critical applications. However, it is not usually possible for a manu-

Continued on page 18

it makes sense
ONE SOURCE
ONE RESPONSIBILITY
for all
COOLING
Requirements



Young / Heat Transfer Specialists

ONE source, one responsibility for all cooling requirements is the sensible approach to solving heat transfer problems. By using one reliable source, you automatically solve problems of service, and there is never a question of responsibility for performance. Young's wide range of products and over 30 years experience in designing, engineering and manufacturing radiators, oil coolers and heat exchangers qualifies them as the most logical source for all your cooling needs. Let us show you what undivided responsibility can mean in the way of economy, quality control and efficiency of performance. Write, wire or call without obligation.

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Acquaint yourself with Young's wide range of products

MAIL COUPON TODAY FOR FREE CATALOGS...

Check the catalogs and literature you would like to receive. Mail coupon to Young Radiator Co., Racine, Wisconsin, Dept. 449-C.

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☐ Cat. No. 1258 and No. 1156 — Shell and Tube Heat Exchangers
☐ Cat. No. 1054A — Young Torque Converter Coolers
☐ Cat. No. 3558 — Type 'OH' Unit Oil Coolers

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Company .....
Address .....
City ..... Zone ..... State .....

Circle **155** on Time-Saver Card

NEW
Actual Size
Best performance of any pressure regulator this small ...at a low, low price!

Norgren

PRESSURE REGULATOR

⅛" and ¼" pipe sizes

for Air, Non-corrosive Gases and Liquids

Best performance of any unit this size

Air Flows Up to 20 cfm at 100 psi air pressure.

Accurate Pressure Regulation even with widely fluctuating line pressure and rapidly varying air flow.

Maximum Primary Pressure: 400 psi.

Maximum Delivery Pressure: 100 psi.

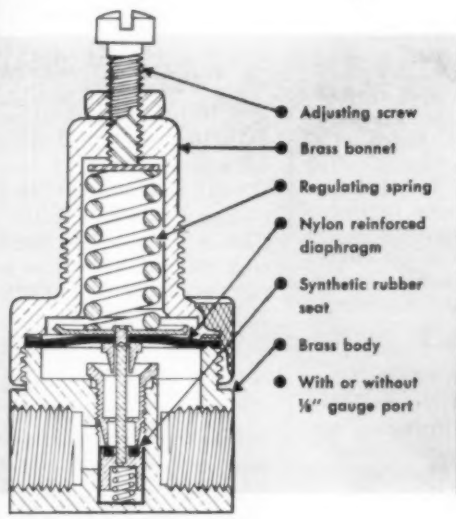
Maximum Operating Temperature: 200°F.

Small Size

The small size of this regulator—only 3¼" high and 1½" in diameter (without gauge)—makes it ideal for installations where space is tight.

Low Price

The lowest price ever for a top quality, dependable pressure regulator.



Plus these important features . . .

- **EASY TO INSTALL**—In-line pipe connections. May be installed in any position.
- **EASY MAINTENANCE**—Should service be necessary, the regulator can be quickly and easily disassembled without removing from line.
- **WITH OR WITHOUT PRESSURE GAUGE**—1½" gauge, 160 psi full scale reading, back mounted.
- **FLOW DIRECTION**—Right to left or left to right.
- **PANEL OR BRACKET MOUNTING AVAILABLE.**

If it's Norgren . . . It's Dependable.

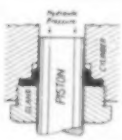
For complete information call your nearby Norgren Representative listed in your telephone directory —or WRITE FACTORY FOR BROCHURE No. 918.

C. A. NORGREN CO.

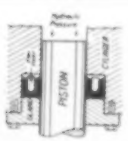
3402 SO. ELATI STREET • ENGLEWOOD, COLORADO

Page... a dependable source for mechanical packings

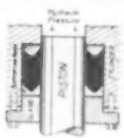
Cup packing



Flange packing



"U" packing



"V" packing

Available with permanent type impregnants for temperatures to 225° F.

When you have exacting specifications to meet . . . plus a budget to watch . . . it will pay you to check with Page. You'll get the right packings fast . . . including packings with permanent type impregnants for temperatures from −65° F. to 225° F. . . . and benefit from the engineering know-how and complete facilities of an organization with nearly a century of experience.

You'll find a complete line of U's, V's, Cups and Flanges, made from various leathers with special impregnations to meet a wide range of applications. Standard synthetic packings also available.

Specify Page Packings. You'll get complete cooperation and a dependable source of supply. Write for your copy of the Page Packing Manual.

PAGE BELTING CO. trademark

PAGE BELTING COMPANY
established 1868

Concord — New Hampshire

Page Packings — engineered to do a better job

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LETTERS

facturer to present such data for his complete line. Standards of temperature, lubrication, and accuracy of pressure would have to be established. It's questionable whether general application of air valves warrants this effort on the part of the manufacturer. Also, pressure drop can be different for flow in different directions through a valve.

Your question of cycling speed must be answered in much the same way. Certainly it can be an important factor in specific applications. A point to be considered in high speed cycling is how much air can pass at the higher frequencies. A valve may be capable of cycling at 600 cycles per minute, however, the amount of air that gets to the connected cylinder is the important factor. Of course this cycling speed also indicates the speed of valve shifting even though only one cycle is involved.

Perhaps some of our readers may have additional information.

Hydraulic Textbooks

TO THE EDITOR:

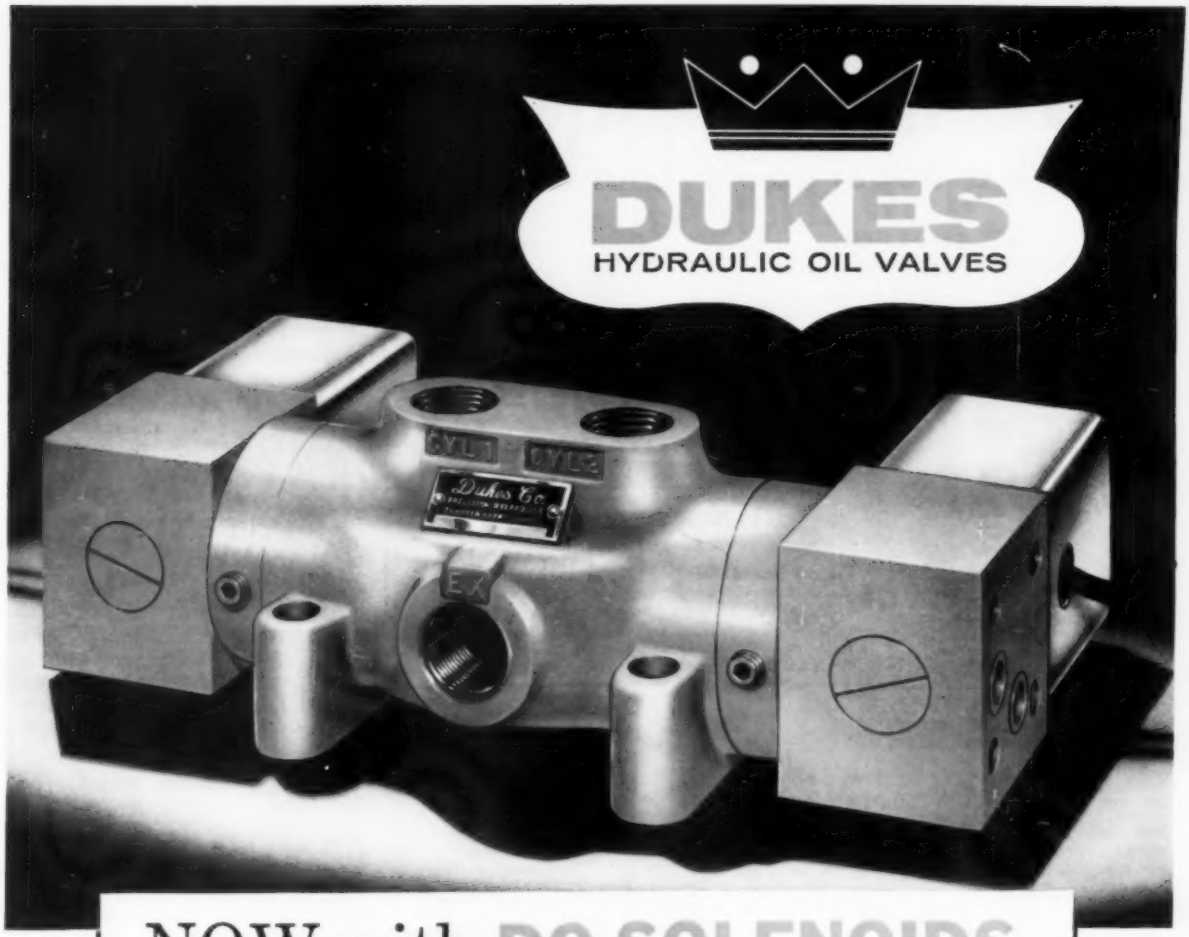
I'm starting a hydraulics class for our employees. I have your *Aircraft Hydraulic Design* by George Keller and would appreciate it if you could furnish me with additional literature or texts that might be valuable in this class.

FRED T. SMITH
Director of Research
Whiting Corp.
Harvey, Ill.

We have sent you information on the FLUID POWER DIRECTORY *which would be most helpful to your group. It includes a 224-page section of basic design information. Price per copy is $6.50. However if you order them for class use, in a quantity of 20 or more, the price will be $3.25 each.*

Price of Keller's AIRCRAFT HYDRAULIC DESIGN *is $4.50 each. In quantities of 10 or more, the price is $4.00 per copy.*

Continued on page 20



NOW with DC SOLENOIDS

6, 12, 24 or 36 volts

Only $10 extra per solenoid • Immediate delivery

A COMPLETE LINE OF TOP QUALITY VALVES

• Available for pressures up to 3000 PSI • Choice of 4 spool actions: spring centering, spring offset, no spring in detent or friction pad type • Choice of 3 standard spools and 5 alternates • Tandem spools available at no extra cost • ½" and ¾" pipe sizes. • Full area internal porting

*Check these prices**

Lever Operated—No Spring..... **$52.00** retail
Stem Operated—No Spring..... **$50.00** retail
Cam Operated—Spring Offset..... **$62.00** retail
Air Pilot Operated—No Spring... **$73.00** retail
Oil Pilot Operated—No Spring.... **$42.00** retail
Pilot Operated, Solenoid Controlled —No Spring..... **$90.00** retail
Add $10.00 for each D.C. Solenoid

*Prices applicable in the U.S.

Send for complete new catalog on standard valves

DUKES Hydraulics

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FOR YOUR PRODUCT OR YOUR PLANT

There's a Roper to Fit Your Needs

Series T .3 to 55 GPM
Choice of 192 Models

Pump and motor units . . . pump serves as end bell of motor. Require minimum space . . . easily installed . . . no coupling required . . . mount in any position. Each unit approximately same size as NEMA motor of HP required for driving. Open drip proof or totally enclosed motors; single or three phase as required.

ROPER
ROTARY PUMPS

Series F 1 to 300 GPM
Pressures to 300 PSI

Feature helical steel pumping gears, hardened steel shafts, bronze flange-type bearings. 4-port design with 8 optional piping arrangements (4 for CW and 4 for CCW rotation) solves installation problems. With or without built-in relief valve in either mechanical seal or packed box construction.

ROPER
ROTARY PUMPS

Series K ¾ to 50 GPM
Pressures to 150 PSI

Extremely compact in all sizes. Helical pumping gears are hardened steel, with steel shafts and bronze bearings. Sizes 10 through 50 GPM have patented venturi suction and discharge principle for smooth flow and quiet operation. With or without built-in relief valve; packed box or mechanical seal.

ROPER
ROTARY PUMPS

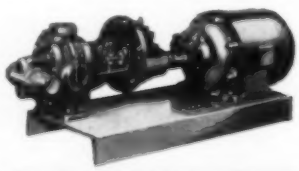
Series H 5 to 75 GPM
Pressures to 1000 PSI

Designed to operate at direct motor speeds. Used for all types of hydraulic mechanisms where high pressures are required. Hardened steel spur gears for maximum efficiency, and heavy duty roller bearings and bronze wear plates for long life service. Mechanical seal or packed box.

ROPER
ROTARY PUMPS

Series 3600 40 to 300 GPM
Pressures to 100 PSI

Handle thick or thin liquids at slow speeds. Operate in either direction. Hardened iron pumping gears, hardened steel shafts, heavy duty bronze sleeve bearings. Mechanical seal or packed box. Series includes tank truck pumps as well as single motor driven units with gear reduction.



ROPER
ROTARY PUMPS

See Our Catalog in Sweets'
Send for "How to Solve Pumping Problems"

Roper Hydraulics, Inc.
703 Blackhawk Park Avenue
Rockford, Illinois
Manufacturers of Standard, Special and Custom Pumps for All Industries

Circle **122** *on Time-Saver Card*

LETTERS

January Guide Issue:

TO THE EDITOR:

Congratulations on your excellent January 1959 Designers Guide Issue.

We would appreciate receiving an extra copy of this issue as a quick guide for our engineering department.

E. G. TAUSSIG
Sales Manager
N. P. Nelson Iron Works
Clifton, N. J.

TO THE EDITOR:

As a manufacturer of hydraulic and pneumatic valves I found your January Designers Guide Issue of great interest. Your section Quick Guide to Product Selection is by far the most complete I have found.

I would appreciate a reprint of this section for my engineering, sales, and purchasing groups.

JAMES TRANOS
Purchasing Agent
Hydra-Power Corp.
New Rochelle, N.Y.

TO THE EDITOR:

We wish to order 12 copies of your 1959 Designers Guide Issue containing the Quick Guide To Product Selection.

RALPH B. MALSOM
Sales Promotion Dept.
Le Roi Division
Westinghouse Air Brake Co.
Milwaukee, Wis.

We're certainly pleased with the excellent response we've had with regard to the January 1959, Designers Guide Issue. Complete extra copies of this issue are available at $1.00 for a single copy; 75¢ each for 25 to 49, and 40¢ each for 50 or more.

Under the listing of Cylinders, Air, we failed to list Westinghouse Air Brake Co., Industrial Products Division, Wilmerding, Pa., who have a very complete line of industrial piston and diaphragm type air cylinders. They make both tie rod and non-tie rod types in bore sizes to 8-inches and above, with operating pressures to 500 psi. They can be supplied in a variety of mountings with any standard packing. □□□

NEW PRODUCTS

NEW ANCHOR HOSE FOR EXTRA HIGH PRESSURES

"Super-Spiral" Hose Opens New Pressure Ranges For Hydraulic Equipment

Hydraulic engineers attempting to design equipment utilizing higher operating pressures, have been defeated by absence of hose capable of handling these higher pressures. Recognizing the need, Anchor has just introduced a new spiral wound wire reinforced hose designed for use with substantially higher pressures.

ANCHOR SUPER-SPIRAL High Pressure Hose is available in both 4 ply and 6 ply spiral wound wire reinforced styles and in sizes from 3/16" I.D. to 1½" I.D. A 2" I.D. size is now under development for early availability.

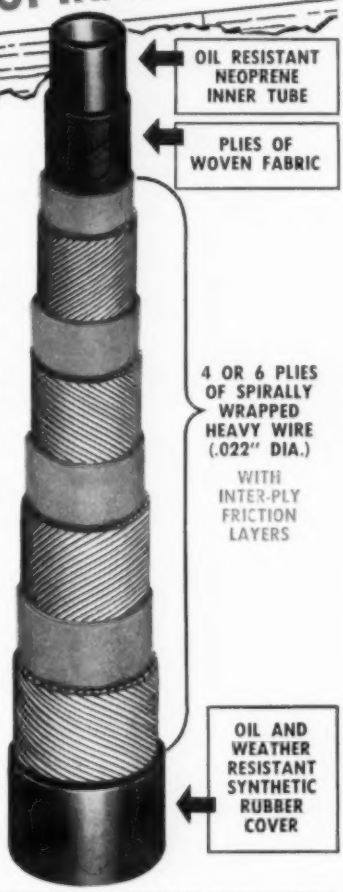
Maximum working pressures of the new 6 ply hose range from 12,500 psi for 3/16" I.D. to 3000 psi for 1½" I.D., and for the 4 ply, from 10,000 psi 3/16" I.D. to 2,500 psi 1½" I.D. By the substitution of spirally wound wire reinforcement for the conventional wire braid, heavier wire (.022") can be used and the wire fatigue, caused by the crossed wires of the braid, is eliminated. This makes a stronger hose capable of handling much higher pressures without excessive increase in bulk and rigidity.

SUPER-SPIRAL Hose has an oil resistant neoprene inner tube and an oil, weather and abrasion resistant synthetic rubber cover with friction layers between each spiral wire reinforcement. It is available in assemblies fitted with Anchor Pressed-On Couplings.

A supplement to Catalog 101 describes the new SUPER-SPIRAL High Pressure Hose and may be obtained from Anchor Coupling Co. Inc., 361 No. Fourth St., Libertyville, Ill.

EXTRA!

HIGHER HYDRAULIC PRESSURES NOW FEASIBLE WITH NEW ANCHOR "SUPER-SPIRAL" HOSE


OIL RESISTANT NEOPRENE INNER TUBE
PLIES OF WOVEN FABRIC
4 OR 6 PLIES OF SPIRALLY WRAPPED HEAVY WIRE (.022" DIA.)
WITH INTER-PLY FRICTION LAYERS
OIL AND WEATHER RESISTANT SYNTHETIC RUBBER COVER

Designers of hydraulic equipment wishing to increase pressures have been hampered by the lack of dependable, extra high pressure hose. With the introduction of Anchor's "SUPER-SPIRAL" Hose, these limitations have been removed. This hose is already finding wide usage in the replacement of old style braid hose to obtain greatly extended service life.

This hose, available in sizes from 3/16" to 1½" has either 4 or 6 plies of all spirally wound heavy wire reinforcement, with no crossed wires to fatigue, break and weaken hose.

It offers a completely new maximum pressure range for the hydraulic engineer,—opens up new horizons for the hydraulic designer.

- **4 or 6 Plies of Spirally Wound Wire Reinforcement**
- **Maximum Working Pressures from 12,500 psi (3/16" I.D.—6-Ply) to 2500 psi (1½" I.D.—4-Ply)**
- **Heavy Wire, .022" Dia., Reinforcement**
- **All Spirally Wound—No Braid, No Crossed Wires That Lead to Wire Fatigue**
- **Available with Any Anchor Pressed-On Couplings**

Andy Anchor says: You will find all descriptive details and specifications on Anchor's new "SUPER-SPIRAL" High Pressure Hose and the Couplings in a special data sheet now available on request.

I.D.	FOUR PLY		SIX PLY	
	MAX. WORK. PRES. (psi)	MIN. BURST. PRES. (psi)	MAX. WORK. PRES. (psi)	MIN. BURST. PRES. (psi)
3/16"	10,000	40,000	12,500	50,000
1/4"	8,750	35,000	11,250	45,000
3/8"	7,500	30,000	10,000	40,000
1/2"	6,250	25,000	7,500	30,000
3/4"	5,000	20,000	6,250	25,000
1"	4,000	16,000	5,000	20,000
1-1/4"	3,000	12,000	3,500	14,000
1-1/2"	2,500	10,000	3,000	12,000
*2"	2,000	8,000	2,500	10,000

*Under Development

ANCHOR COUPLING CO. INC.

360 No. Fourth St., Libertyville, Ill.
Branch Plants: Dallas, Texas; Plymouth, Michigan

Circle **13** *on Time-Saver Card*

NATIONAL OIL SEAL LOGBOOK

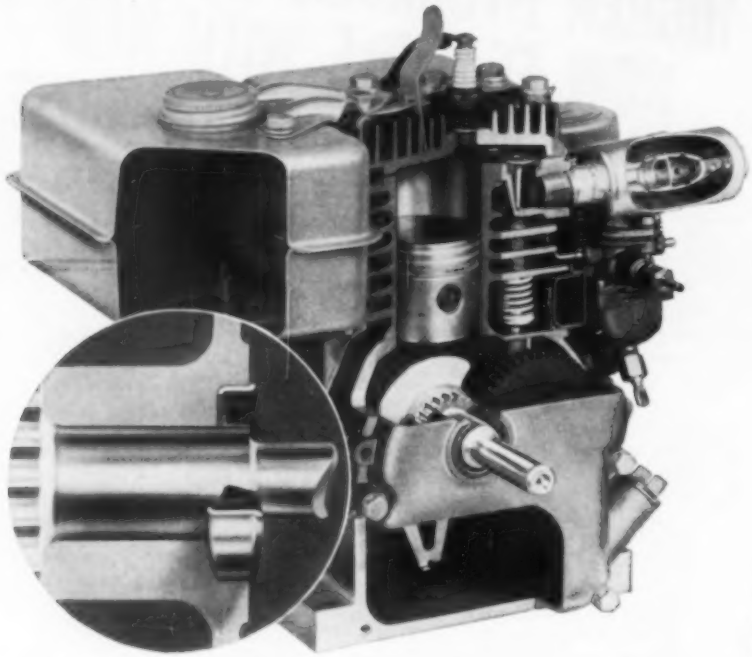


Figure 1.

Zero leakage oil sealing a "must" in Briggs & Stratton 2¾ hp engine

Some oil sealing applications can accept a small amount of lubricant leakage or "seepage." But not the Briggs & Stratton 8B Engine. Here, on a ⅞" crankshaft turning up to 3,600 RPM, light engine oil must be positively sealed in the crankcase at both front and rear bearing points. Oil temperature is 200° F with the engine at wide open throttle; and external temperatures may range from —30° to 125° F. Many Briggs & Stratton 8B engines operate only after long periods of inactivity; others are used continuously, a variable which makes the sealing problem even more demanding.

Satisfactory sealing and long, trouble-free service life is obtained by use of two special National Syntech® synthetic rubber seals (Fig. 1)—one at either sealing point. These precision made Syntechs have a minimum-contact sealing lip seating lightly but firmly on the shaft. The steel outer case is a precise press-fit for the bore, simplifying installation and preventing accidental working free of the seal.

National pioneered Syntech synthetic rubber seals; today offers a complete line of Syntech and leather seals plus convenient, competent oil seal engineering assistance. For data, for practical design help, call the National Seal engineer. He's under Oil Seals, in the Yellow Pages.

Variations on basic oil seal designs

10,000-S

Many modifications of the basic National spring-loaded Syntech oil seal design are offered. For example, where external conditions require a felt dust baffle, National 10,000-S may be employed. Where dirt or grit conditions are severe, a National 20,000-S with leather or Syntech auxiliary sealing lip is often used.

230,000-S

For applications where shaft entry is made from the auxiliary side, a National 230,000-S seal with auxiliary leather washer-type sealing lip mounted *in tandem* is suggested.

70,000-S

For positive separation of low viscosity fluids at higher speeds and temperatures, National 70,000-S series seals are suggested. Basically two 50,000-S seals mounted with sealing lips opposed, this seal may be used at temperatures above 250° F and speeds in excess of 2,000 FPM.

Altogether, National offers over 2,500 basic types and sizes. There is one best seal for a given application. Your National engineer can help you obtain it.

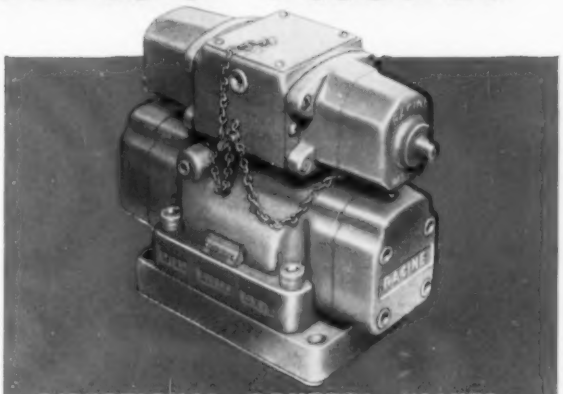
NATIONAL SEAL

Division, Federal-Mogul-Bower Bearings, Inc.
General Offices: Redwood City, California;
Plants: Van Wert, Ohio, Downey and Redwood City, California

RACINE-SECO

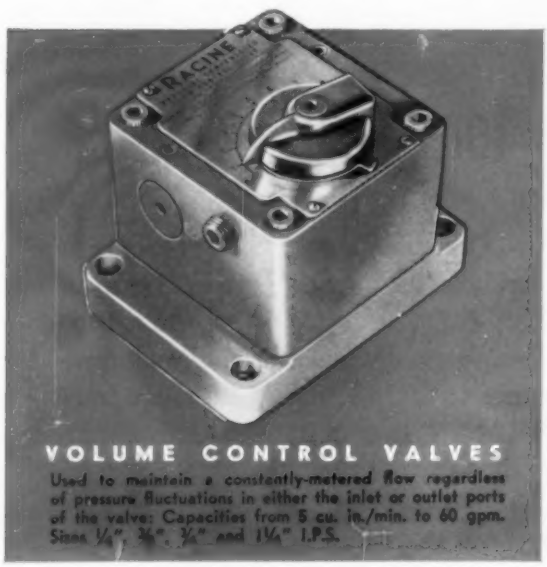
Hydraulic control valves

Racine-Seco hydraulic circuit components are the result of years of experience in engineering and development. Shown here are representative types of a complete line of quality-designed, quality-built dependable control valve equipment that will efficiently perform their specific function in today's modern hydraulic circuit design.



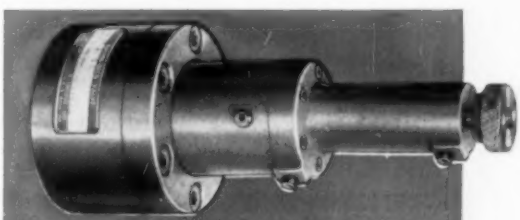
DIRECTIONAL CONTROL VALVES

Compact streamlined design — dust proof construction. Mechanical, manual, pilot and electrical operation available in 2 way and 4 way valves — foot and panel mounting. Sizes ¼" to 2" — 1500-2000-3000 PSI. Complete line of pilot operated, spring loaded, angle type and straight check valves available from ¼" to 3".



VOLUME CONTROL VALVES

Used to maintain a constantly-metered flow regardless of pressure fluctuations in either the inlet or outlet ports of the valve: Capacities from 5 cu. in./min. to 60 gpm. Sizes ¼", ⅜", ½" and 1¼" I.P.S.



PRESSURE CONTROL VALVES

Designed to provide sensitive precision control of pressures up to 10,000 PSI. Complete line includes Relief, Unloading, Sequence, Counter Balance, Reducing and Resistance Valves. Capacities up to 60 gpm.

All RACINE-SECO *Hydraulic Control Valves are designed to conform to J.I.C. specifications. Write for complete descriptive Catalog 59-A.*

RACINE SECO

RACINE HYDRAULICS & MACHINERY, INC.

2074 Albert Street RACINE, WISCONSIN

One Source — One Responsibility FOR ALL YOUR HYDRAULIC NEEDS

ECONOMICAL...

for every point of use....

Fulflo Filters for Compressed Air

Fulflo Filters minimize gumming and remove moisture, oil, microscopic rust, dust, dirt and scale from your air lines. They are rugged, compact and economical for low-cost installation at every point of use.

The BA Models (illustrated) are made in three sizes — for 3", 5" and 7" Honeycomb Filter Tubes. Maximum flow rate is 150 scfm at 125 psi, through a 7" element, with an initial pressure loss of only 3 psi. Metal baffle deflects oil and moisture to sump. Positive seal at top and bottom prevents by-passing.

Other single-tube Fulflo Filters are available for operating pressures up to 250, 450, 750 or 4,000 psi. Multi-tube models are designed for operating pressures to 150 psi. Pipe sizes range from 1½" NPT to 6" NPT.

For new booklet on Fulflo Filters for compressed air and other gases, write Dep't AH.

COMMERCIAL FILTERS CORPORATION
MELROSE 76, MASSACHUSETTS
PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

MICRO-CLARITY AT MINIMUM COST

Fulflo FILTERS — *with genuine Honeycomb Filter Tubes for controlled micro-clarity of industrial fluids.*

CFC FILTERS — *Selective filtration of oils • water-oil separators • magnetic separators • pre-coat filters • coolant clarifiers • automatic tubular conveyors.*

interchangeable with all standard JIC cylinders

With the introduction of the ALL NEW T-J Squair Head, Tomkins-Johnson now offers industry the most complete design range of air and hydraulic cylinders. Presently available in bore diameters from 1½ to 8 inches, the T-J Squair Head is an interchangeable cylinder which produces maximum force and efficiency, with minimum pressures . . . and is also adaptable to the use of low pressure oil as the working medium. Write to The Tomkins-Johnson Co., Jackson, Michigan, for Bulletin #SQ 10-58 and complete details.

CHECK THESE 10 POINTS OF T-J SUPERIORITY

1 One Piece Piston

2 Hard Chrome Cylinder Bore and Piston Rods

3 High Tensile Steel Tie-Rods

4 Cushion Adjusting Screw, Externally Adjustable

5 New Super-Cushion for air, or Self-Aligning Master Seal for Oil (T-J Patents)

6 Solid Steel Heads and Mounting Plates Standard all Models

7 Port Design Allows Minimum Pressure Drop on Inlet or Outlet

8 Chevron Type, Self-Adjusting Rod Packing

9 Piloted Packing Gland—Absolute Alignment

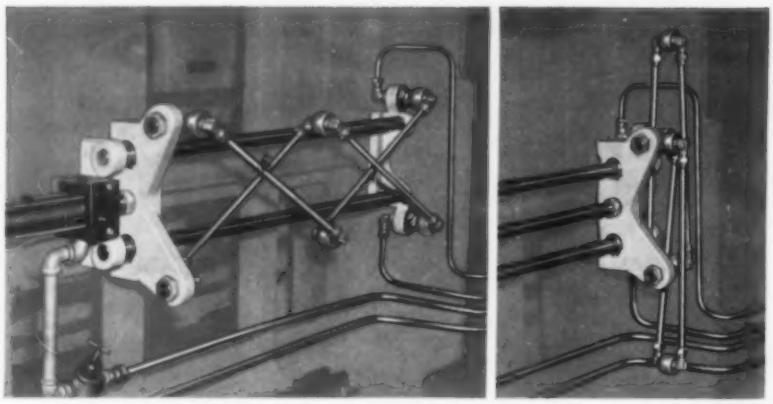
10 Piston Rod, Extra Strong—Polished and Chrome Plated for Efficiency and Protection

T-J TOMKINS-JOHNSON

IN EQUIPMENT DESIGN

CHIKSAN SWIVEL JOINTS

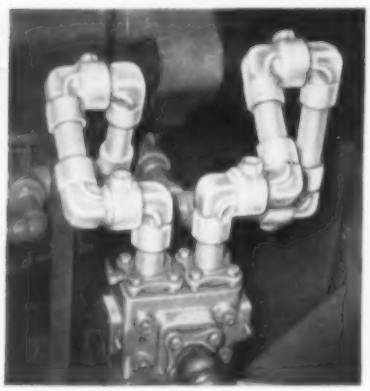
SMOOTH OUT KNOTTY LINE PROBLEMS



STEEL LINES FOLD LIKE AN ACCORDION

Connected to a moving head, these compact swivel jointed all-metal hydraulic lines flex and fold like an accordion on this automatic bottle unpacking machine.

When a machine's moving parts cause tight bend or twist on hose lines, Chiksan Swivel Joints provide a ready solution. When design dictates the use of metal lines, Chiksan Swivel Joints allow rubber-like flexibility. In fact, wherever line flexibility is required, designers and maintenance engineers know it's just good business to call on Chiksan. Precision made Chiksan Swivel Joints with their infinite service life, full 360° rotation and high safety factor, quickly pay for themselves by minimizing hose replacement and eliminating costly line failure, fluid loss and downtime. If your equipment hose lines require frequent replacement due to torsion or bend radii fatigue, or if flexible all metal lines are in order, contact Chiksan. A nearby representative will call, analyze your requirements, and make specific recommendations. Write today for his name.

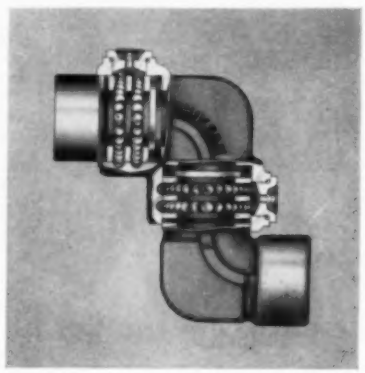


NO HOSE BURST HERE

These Chiksan swivel jointed steel lines on a die casting machine eliminate damaging hose ruptures, reduce fire hazard, fluid loss and setup time by 75%.

NO BEND FATIGUE HERE

This highly specialized lens grinder utilizes Chiksan Swivel Joints to eliminate tight hose bend as the multiposition head is shifted from one grinding position to another.



LOOK INSIDE A SWIVEL JOINT

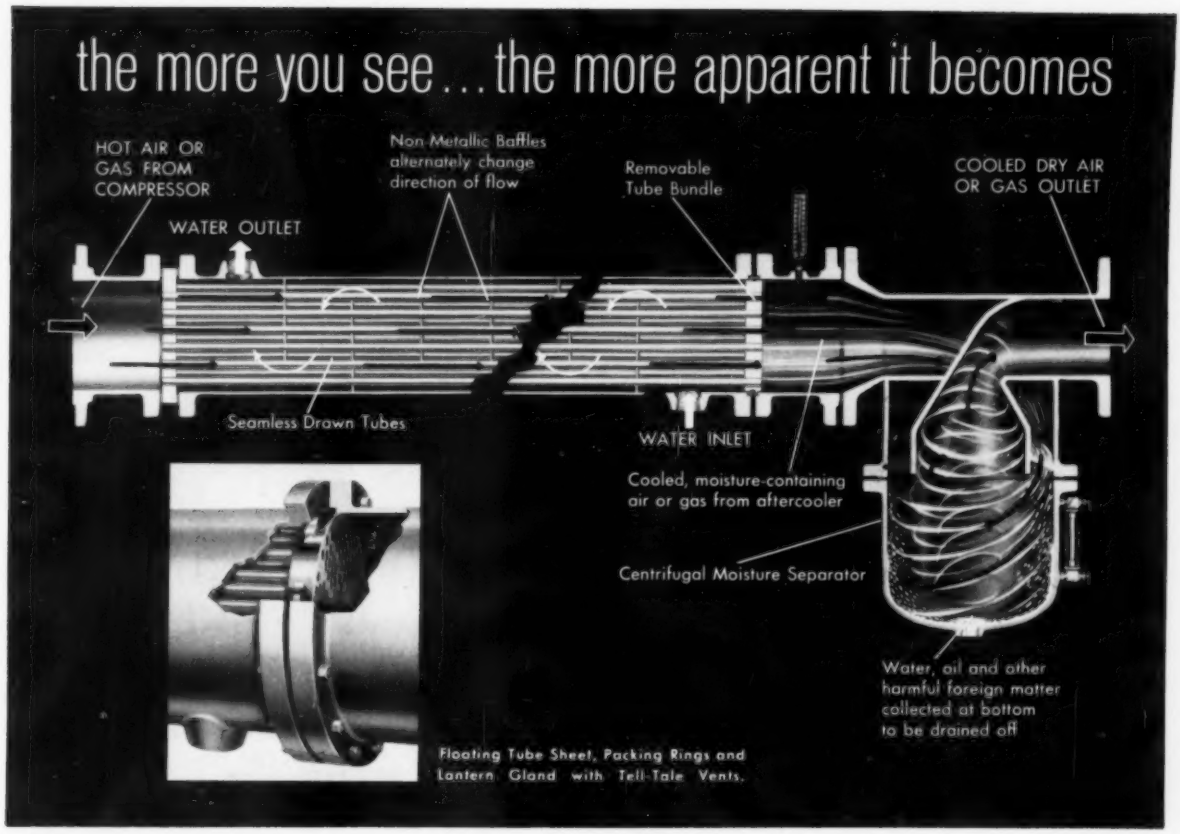
Detailed attention to detail. Precision machining and specific packing seals for specific services. These are the quality-plus features built into every Chiksan Swivel Joint.

CHIKSAN

fmc A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

CHIKSAN COMPANY—BREA, CALIFORNIA • CHICAGO 5, ILLINOIS • NEWARK 2, NEW JERSEY

Well Equipment Mfg. Corp. (Division), Houston 1, Texas • Subsidiaries: Chiksan Export Company • Chiksan of Canada, Ltd.


the more you see... the more apparent it becomes
HOT AIR OR GAS FROM COMPRESSOR
WATER OUTLET
Non-Metallic Baffles alternately change direction of flow
Removable Tube Bundle
COOLED DRY AIR OR GAS OUTLET
Seamless Drawn Tubes
WATER INLET
Cooled, moisture-containing air or gas from aftercooler
Centrifugal Moisture Separator
Water, oil and other harmful foreign matter collected at bottom to be drained off
Floating Tube Sheet, Packing Rings and Lantern Gland with Tell-Tale Vents.

NEW ROSS PIPELINE AFTERCOOLERS

are today's most effective means of cooling and drying compressed air

Here, cut away for your inspection, is the new Ross Type A-100 Pipeline Aftercooler . . . the "inside story" with everything revealed.

Note how the air in the tubes flows counter to the water in the shell so that the coldest (incoming) water serves the coldest (outgoing) air. Note, too, how the air is baffled into a swirling eddy within the moisture separator to force (centrifugally) water and all other entrainment from the line.

Examine every feature! The more you see, the more apparent it becomes: *This new aftercooler is the most efficient unit ever built for air compressor service.*

Equally important is the fact that fully standardized parts are utilized to eliminate costly "specials" in both engineering and fabrication. You save in every way.

Compact and easy to install, a Ross A-100 can be readily fitted into any compressed air system. There are 54 models to choose from, with capacities ranging from 0 to 36,000 scfm at operating pressures up to 150 psig for single or two stage compression.

Why not see all there is to see? New Bulletin 302.6K1 contains the complete, illustrated story as well as specifications. Send the coupon for your copy now.

*American-Standard and Standard ® are trademarks of American Radiator & Standard Sanitary Corporation.

AMERICAN-Standard
INDUSTRIAL DIVISION

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Mail this coupon for new Bulletin

TO
American-Standard*
Industrial Division
Detroit 32, Mich.

SEND your new Bulletin 302.6K1 describing Ross Type A-100 Pipeline Aftercoolers.

NAME _____
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AH 359

BRIEFS

about fluid power

HYDRAULICS GIVES POWER BACK TO ELECTRIC MOTOR

On oil powered elevators where gravity can do the job of lowering there's a chance to give some power back to the electric motor which drives the hydraulic pump. Circuitry is designed to change the pump into a fluid motor while the elevator goes down. The fluid motor drives the electric motor to put power back into the electric system. This design idea for power economy is important on ships. Designers of elevators used on freighters built for Canadian Steamship Lines have installed hydraulic systems which have this power saving feature.

Each hydraulic platform elevator, designed to lift 10 tons with an overload capacity of 14 tons, is powered by a two-way, variable-displacement piston pump. Delivering up to 104 gpm at pressures up to 1100 psi, the pump provides fluid power to, or meters from, two, single-acting hydraulic cylinders. Finger tip movement of the pump lever control regulates the speed and direction of the elevator.

Because the electric system can't absorb all the energy which could be returned, the hydraulic package includes a special valve to limit the amount of energy returned.

HYDRAULIC SYSTEM and simple chain and sprocket mechanism allow unobstructed access to the elevator platform from all four sides.

• **Level control**—There's also a control which stops and holds the platform level when reaching the deck regardless of load. A spring centered hand lever control is connected to the remote pump through a chain and series of sprockets. When the elevator reaches the preset top or bottom positions, the control lever automatically moves the pump mechanism to neutral (no delivery). Any drop or overtravel will cause the control chain on the elevator to actuate the pump control and move the pump off stroke. Fluid then flows to or from the cylinders to level the platform. The control lever is equipped with a detent mechanism which permits the operator to move the pump control in either direction irrespective of elevator position.

• **Safety**—A three-way, solenoid-operated fail-safe pilot valve interlocked electrically with drive motor starter automatically prevents the elevator platform from descending when power fails or drive motor is shut off. When the drive motor is running and the solenoid is energized oil will flow through the circuit. When power fails or motor is shut off the solenoid is de-energized and pressure is trapped to hold the cylinders. Entire hydraulic system was developed by The Oilgear Company. □□□

Continued on page 30

Push Operated, Detented or Spring Return.
Lever Operated, Detented or Spring Return.
Ball Actuated Spring Return.
Pilot Operated Spring Return.
Double Pilot Operated.
Pilot Operated Bucking Cylinder Return.
Single Solenoid Spring Return.
Double Solenoid Momentary Contact.

HUNT

new unique Slim Line

CONTROL VALVES

Now available with 8 types of operators. 3-way and 4-way actions. Easily manifolded into compact control centers.

● You'll like these new valves. Only 1″ thick by 3″ wide, they are exceedingly compact and light in weight; can be mounted easily on machines even when space is extremely limited.

Ideally suited for controlling small cylinders, to operate pilots and similar services. ⅛″ or ¼″ pipe tapped. Pressures to 125 p.s.i. Air, water, oil or vacuum service. Stock delivery.

Solenoid valves have the following features as standard; manual over-ride; ½″ NPT conduit connections; valve inoperative with solenoid cover removed.

The side of each valve is counter-bored, trepanned for an "O" ring, and provided with four through holes permitting up to eight valves to be manifolded together and operated from a single supply. Better get full details — now!

Six Single Solenoid Valves Manifolded into a Compact Unit Using Standard Brackets and Tie Rods.

More startling HUNT designs to come!

40 YEARS

HUNT

Quick-As-Wink® AIR AND HYDRAULIC CONTROL Valves

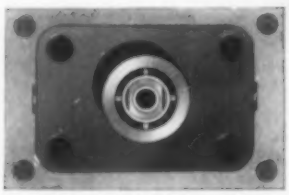
Send for the "SLIM LINE" Bulletin No. 581 TODAY!

Manufactured by HUNT VALVE COMPANY, 1991 East Pershing St., Salem Ohio

Circle **73** *on Time-Saver Card*

YOUR BONUS from Pathon HYDRAULIC CYLINDERS

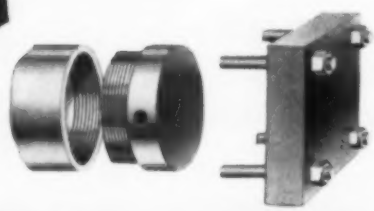
For the Designer



Pathon's compact design saves valuable space, makes your designing job easier, and gives your equipment that modern, rugged look.

For the User

Pathon's screw thread head design gives you up to 40% more strength than most tie-rod cylinders. This increased strength means less maintenance, and longer life.



For the Maintenance Man

Rod packing and bearing is externally replacable and any part can be replaced without complete disassembly and the resulting "basket full of parts".

FOR YOU

Let us give you a "Rod Column Effect" calculator. From this easy-to-use slide rule obtain optimum rod diameter for a given load and stroke.

Write for Calculator and Bulletin No. 22-A

Pathon MANUFACTURING COMPANY

3823 PACIFIC AVE. • CINCINNATI 12, OHIO

8-59

FLUID OPERATED AND CONTROL EQUIPMENT

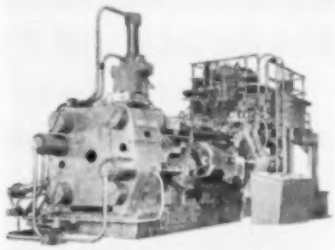
Circle **112** *on Time-Saver Card*

BRIEFS

Design Engineering Show

The 4th annual Design Engineering Show will be held at Convention Hall in Philadelphia May 25 to 28. The machine design division of ASME is sponsoring a Design Engineering Conference to run concurrently with the show.

More than 400 companies are expected to exhibit. Over 18,000 attended last year, of which 73% were engineers, and 27% management personnel. Information may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. □□□



TWO, VARIABLE-VOLUME hydraulic pumps driven by a 350-hp, double-ended motor furnish power for this 1500/1800-ton aluminum extrusion press. Main cylinder is made in two pieces. Constructed by Sutton Engineering Co., Pittsburgh, Pa.

Hydraulics Automates Metal Forming Machine

Double end transfer machine performs up to six metal forming operations on each end of tubular or solid stock. The hydraulically-operated, electrically-controlled machine has two opposed motorized power heads mounted on a steel base that encloses the hydraulic power unit. Heads are positioned on slides so that parts from 1 to 10-ft long can be handled on the machine.

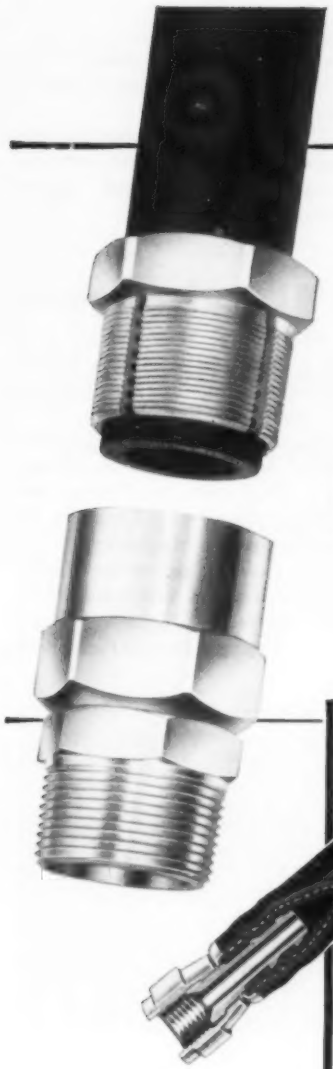
A transfer mechanism, consisting of a chain conveyor operated

Continued on page 32

Distributed nationally for immediate delivery—
The Complete Line of

ALEMITE SURGEPRUF

reusable hose and couplings



The quality line for original equipment . . . the preferred line for fast, easy on-the-job replacements! Let Surgepruf be your one dependable source of hose, couplings and components for every industrial and automotive application! High-pressure, medium-high pressure and low-pressure hose for temperature operating range of −40° to +275°F. Couplings are reusable. Complete range of hose sizes and couplings, as well as adapters and swivel adapters. One of Alemite's 34 strategically located distributors is ready to give you prompt, complete service!

Medium-High and High-Pressure Hydraulic Hose and Fittings. Single and double wire braid hose. Non-skive feature assures easy assemblies in seconds. Seamless inner tube of Buna-N rubber and Neoprene outer cover. Resists abrasion, weather and oil. High strength reusable couplings. No special tools required.

New Low-Pressure "Shur-Lock" Hose—for use on fuel, filter, oil, air and vacuum gauge lines. Rugged, precision-matched couplings. Leak-proof grip. General purpose hose and coupling utility kit eliminates need for large inventory.

Kit No. 2208
Permits fast, easy on-the-spot assemblies for most common low-pressure automotive applications.

Kit No. 2209
For low pressure fleet, automotive and industrial general purpose use.

Kit No. 2207
A complete selection of reusable couplings, adapters and swivel union adapters for most medium-high pressure industrial and farm equipment hydraulic lines.

Write today for Surgepruf Catalogs!

Dept. EE-39, 1850 Diversey Parkway, Chicago 14, Illinois

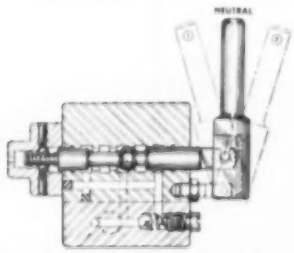
Symbol of SW Excellence

ALEMITE DIVISION
STEWART-WARNER CORPORATION

new 10,000 psi FOUR-WAY VALVES

effortless operation for applications up to 10,000 psi

Have valving problems on hydraulic applications calling for high pressures up to 10,000 psi? This new GREENLEE Four-Way Valve may be your answer. Simple, trouble-free spool-type valve . . . completely balanced to provide effortless operation at any pressure in any position. It operates with the same ease at 10,000 psi as at 0 psi. Panel mounted for universal adaptability. Subplate available. Precision-made, precision-tested. (Max. leakage 4 cu. in. per minute at 10,000 psi.) Write today for illustrated data sheet.



GREENLEE Four-Way Valve is available in two models: No. 1717 (above) with detent-positioned control lever . . . No. 1704 with spring-centered control lever.

THE GREENLEE LINE ALSO INCLUDES A WIDE SELECTION OF HAND AND POWER-OPERATED HYDRAULIC PUMPS

GREENLEE

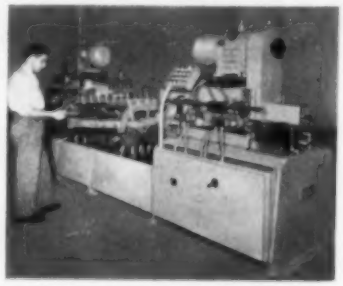
GREENLEE TOOL CO.

1776 Columbia Ave., Rockford, Illinois

Circle **61** *on Time-Saver Card*

BRIEFS

by a hydraulic cylinder-operated index mechanism, moves parts from station to station.



Designed by Walter P. Hill, Inc., Detroit, Mich., the machine has a maximum cycle rate of 3600 pieces per hour. Hydraulic clamps at each of the power heads grip the OD of the part for accurate positioning.

Cylinders also advance and retract the spindles to perform machining or forming operations. □□□

SAE Conference

The central Illinois section of the SAE will hold its 10th annual earthmoving industry conference on April 14 & 15 in Peoria, Ill.

Technical papers will be presented and a panel of representatives from contracting firms will discuss **Desired Trends in Earthmoving Machinery.**

For information write Earthmoving Industry Conference, Box 973, Peoria, Ill. □□□

Continued on page 36

BRIEF NOTES

FLUID POWER IN CANADA . . . There are at least 40 sales agencies with 89 branch offices now selling hydraulic and pneumatic components in Canada. They sell products of 94 manufacturers of hydraulic components and 63 companies making pneumatic components. These sales companies have 344 salesmen in the field.

BLENDED TEFLON . . . Addition of inorganic additives to Teflon's fluorocarbon base improves physical characteristics. Made by Modern Industrial Plastics, Inc., Dayton, Ohio, the blend is 10 times as resistant to deformation as pure Teflon, and has 500 times the resistance to wear.

NAME CHANGE . . . . To clearly indicate their activities, Keelavite Rotary Pumps & Motors Ltd. have changed their name to Keelavite Hydraulics Ltd. The announcement follows an increase in the company's capital together with plans to extend their factory.

LEATHER IMPREGNATION . . . for resistance to wear and water has been studied by the National Bureau of Standards for the Navy. Using 20 percent impregnation of butyl rubber deposited throughout the leather's thickness reduces water absorption 35 percent and increases wear 50 percent.

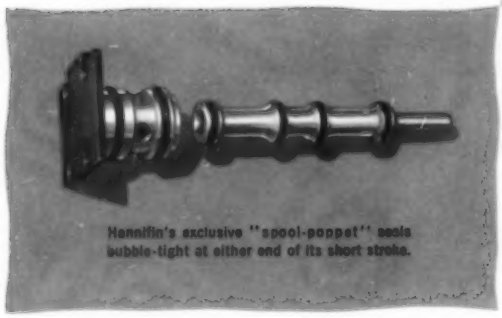
HYDRAULIC TRAINING . . . The organization of an Industrial Hydraulic Training Association was the outcome of Vickers hydraulic workshop. The group will act as a clearing house for dissemination of texts and visual aids, review existing courses, prepare written data for text books, and keep material current. Information can be obtained from Dudley A. Pease, Staff Assistant, NFPA, 1618 Orrington, Evanston, Ill.

PLANT TOUR . . . Twenty-three industrialists from Sweden, Denmark and Finland, toured the Crane Packing Co. plant at Morton Grove, Ill. Purpose of the inspection was to get knowledge of new developments in management techniques. It was sponsored by the Swedish Association of Metal Industries.

For Air "Valve Finder" Circle **66**
For Fittings Circle **110** ➡

From HANNIFIN... unit construction to give you air valves that do more jobs

Hannifin ¾" four-way valve with "universal" base and new Speed Control section. Single-solenoid actuated, 10 other actuators available.



Hannifin's exclusive "spool-poppet" seals bubble-tight at either end of its short stroke.

For complete J.I.C. compliance, valve is electrically inoperative until dust-tight, splashproof solenoid cover is replaced and fastened tightly. Result: no more clogged, jammed solenoids.

One of the versatile—and most popular—Hannifin air control valves is this "CC" series, single-solenoid model. It is available for either ¼" or ⅜" air lines and is gasket-mounted to its own base. This particular base (one of three choices offered) can either be O-ring gasketed to your manifold or mounted over an opening in your bracket or machine. It will receive all four lines from below or take the inlet line from below and the two cylinder lines out one side. Or, you can make all connections at the sides.

When it comes to actuation, Hannifin offers an even wider selection: hand, foot, cam, pressure, single or double solenoid.

When necessary, you can remove this entire valve from its base without disconnecting air lines. Or, the exclusive "spool-poppet" can be replaced without even breaking electrical connections.

The "CC" series, like all Hannifin valves, is designed with "full flow" internal passages as large or larger than its rated pipe size.

You will find these and most other Hannifin valves described in Hannifin's new "Valve Finder." Get your copy from your Hannifin man, listed in the A-Z volume of Thomas' Register, or write:

HANNIFIN COMPANY
525 South Wolf Road • Des Plaines, Illinois

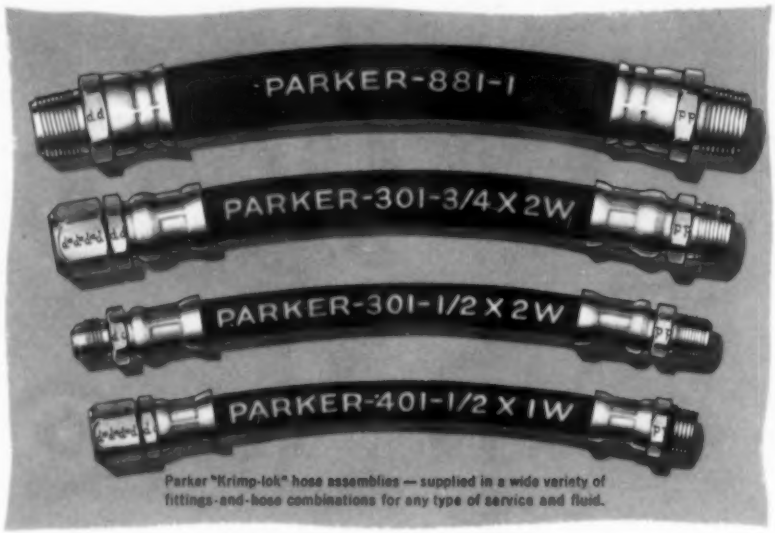
PARKER-HANNIFIN FLUID-SYSTEM COMPONENTS

Now from Parker

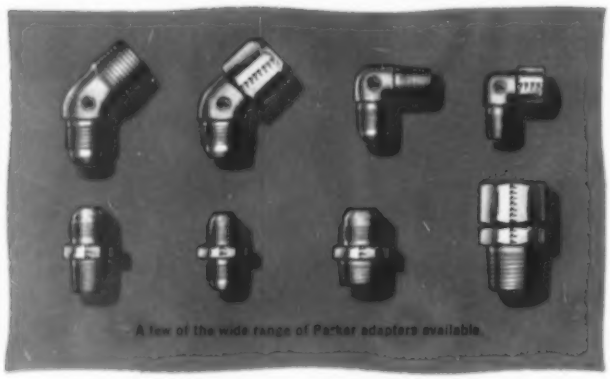
BOTH permanent-end

and re-usable

hose assemblies



Parker "Krimp-lok" hose assemblies — supplied in a wide variety of fittings-and-hose combinations for any type of service and fluid.


A few of the wide range of Parker adapters available.

You may require permanent-end hose assemblies for your production AND re-usable fittings with coils of hose for quick, trouble-proof replacements in the field. With the addition of Parker's new "Krimp-lok" fittings, permanent-end assemblies are now available from Parker. They use the same Parker hoses that enjoy a wide acceptance when used with Parker *no-skive* "Hoze-lok" fittings in the replacement field.

A full range of Parker adapters is also available.

Ask your Parker Hose Distributor, listed in the Yellow Pages, for engineering advice and literature on "Hoze-lok" re-usable fittings, also Parker hose and adapters. Write us in Cleveland regarding your requirements for Parker "Krimp-lok" Hose Assemblies.

Parker

FITTINGS AND HOSE

DIVISION

17325 Euclid Avenue

Cleveland 12, Ohio

Parker "Hoze-lok" no-skive hose fittings and Parker hose, the ideal combination for short-run production and quick, reliable field replacement.

A DIVISION OF PARKER-HANNIFIN CORPORATION

Parker "Krimp-Lok" Hose Assemblies
(by Parker Fittings and Hose Division)
Parker Control Valves (by Parker Hydraulics Division)
HANNIFIN
Mobile Hydraulic Cylinders
(by Hannifin Company — division of Parker-Hannifin)

PARKER-HANNIFIN

creative leader in fluid systems – offers . . .

time-saving 3-in-1 service on hydraulic circuitry to mobile equipment builders

Control valves, power cylinders, hose and hose fittings for the hydraulic systems of your mobile equipment . . . and engineering recommendations, as well . . . are readily available from Parker-Hannifin. Parts and design assistance both are supplied through *one* sales engineer representing all *three* Parker-Hannifin divisions that make these mobile-equipment components.

Parker hydraulic control valves provide positive, finger-tip control of the system . . . Parker "Krimp-Lok" permanent-end hose assemblies are produced in hundreds of combinations of hose types, sizes and fitting designs . . . Hannifin power cylinders, our standards or specially designed for your application, transform hydraulic power into linear motion. All three groups of components are designed to work together at highest efficiency. And where an accumulator will provide shock protection, or added capacity, to your circuit, Parker Hydraulics Division offers these, too.

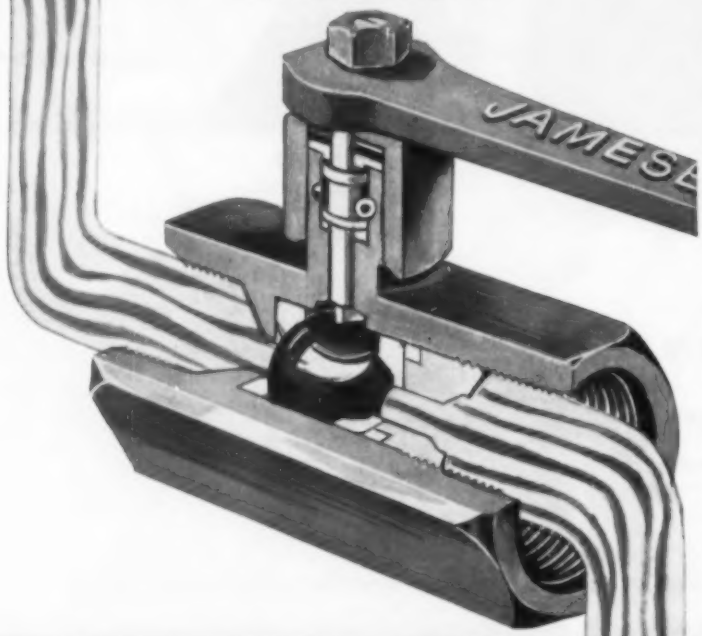
To get all this service from one Parker-Hannifin man, write to D. A. Cameron, Parker-Hannifin Corporation, 17325 Euclid Avenue, Cleveland 12, Ohio . . . or call in your

PARKER-HANNIFIN
MOBILE EQUIPMENT SPECIALIST

REPRESENTING 3 DIVISIONS OF PARKER-HANNIFIN CORPORATION

Now, at your service

Jamesbury
UNIT-BODY
"Double-Seal"™
HIGH-PRESSURE
Ball Valves
STYLE H SERIES



. . . outstanding design newly available to industry

for
- High-Pressure service
- High-Vacuum service
- Handling of hazardous fluids
- Cryogenic operations

. . . no other valve has these outstanding features

- Unit-body construction
- Positively leakproof
- Full-flow capacity
- Indestructible in service
- Corrosion-resistant
- Contamination-proof
- Incomparable size-rating-test-burst performance ratio

—a newly developed and advanced valve design with broad industrial applications, available in eight sizes through 2", with 303 and 316 Stainless Steel or Carbon Steel bodies. Choice of nylon or "Teflon" seats and seals.

"Double-Seal"
Ball Valves

Distributors in principal cities.
For further information, write: Data: Style "H" Series

225-B

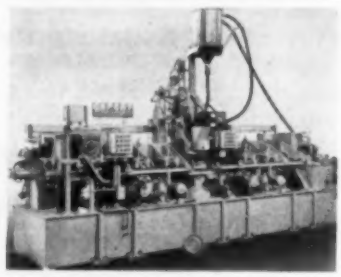
JAMESBURY CORP., 85 NEW STREET, WORCESTER, MASS.

BRIEFS

Tugboat Drive Is Oil-Operated

Power from the 1600 hp diesel engine on the tugboat Margaret M. McAllister is transmitted to the propeller shaft through an oil-powered reverse-reduction gear. Full speed ahead or astern can be reached in 4 seconds from a standing position. The clutch mechanism in the gear is engaged by high-pressure oil from two screw type pumps. Oil-activated ahead and astern clutches are driven by pinion gears on the input driveshaft.

An air cylinder at the gear operates the clutching mechanism. The unit is easily controlled by a remote lever in the engine room or pilothouse. Propeller thrust is 52,000 lbs. □□□



AIR CYLINDERS pivot the transfer bar on this 10-station automatic welding machine. The machine preheats, welds, and heat-treats automatic transmission parts. Air cylinders also move the parts longitudinally along guide rails from station to station. Built by Expert Welding Machine Co., Detroit, Mich.

Curing Problems Cured With Accumulators

In a rubber molding plant where one pump serves a long line of presses, there is always the chance of pressure fluctuation. Curing time varies from 6 to 12 minutes, giving a constantly varying demand at the pump.

To avoid using a separate pump for each press, Berea Rubber Co.,

Continued on page 38

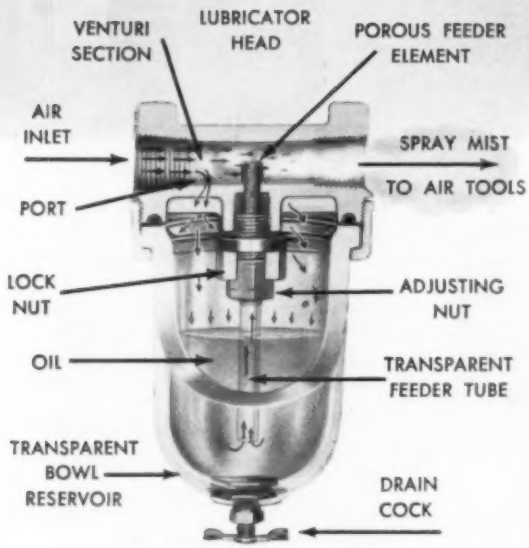
Circle 79 on Time-Saver Card

Circle 14

Arrow AIRLINE SPRAY MIST LUBRICATORS

Supply a fine Spray Mist Lubricant by the most efficient and effective two-stage method!

By PRE-DIVIDING or breaking up the oil in the first stage before completely atomizing the Lubricant in the second stage. The Spray Mist is then carried along throughout the entire pattern of the air stream to lubricate the working parts of air-powered tools, cylinders, valves and other pneumatic devices.



Illustrates the operation of the ARROW "patented" two-stage, tamper- proof Lubricator.

Compressed air from the drop line enters the Lubricator to Venturi section of the Lubricator Head where the porous feeder element protrudes into the Air Stream.

Small ports in front of the porous feeder permits air pressure transfer on the oil surface in the bowl reservoir. The pressure differential created by the Venturi forces the oil to rise in the transparent feeder tube, into and through the porous feeder element which PRE-DIVIDES the Lubricant in this first stage, into minute particles of oil.

The Lubricant now finely divided and saturating the porous feeder element, is now easily and most efficiently atomized from the feeder element, at this second stage, by the action of the Venturi on the compressed air passing through the Lubricator Head.

The two-stage method incorporated in the ARROW LUBRICATOR insures a fine spray mist for wider ranges of AIR FLOWS at lower pressure drops.

Simplicity of design with only one tamper-proof adjustment provides for most efficient, low-cost operation.

PROTECT YOUR PNEUMATIC EQUIPMENT

Complete Conditioning and Control of Compressed Air Prolongs Service Life, Reduces Maintenance and Repair of Air-Powered Tools, Cylinders, Valves and Other Pneumatic Equipment.

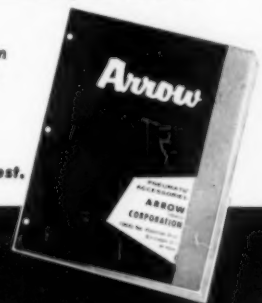
the most Efficient and Complete AUTOPNEUMATIC CONTROL By Arrow

A choice of fine or coarse grade porous Bronze Feeder Wick as required for lubricant or application. A choice of Hand Filling Type Lubricator or a Pressure Filling Type with Button Head Fitting or the ARROW . . . New Fully Automatic Filling Type which with the Automatic Drain Trap makes Autopneumatic Control completely automatic, eliminating all hand or manual servicing.

Many Types and Models of Single Units and Units in Combination Assemblies to Meet Specific Requirements.

PIPE LINE SIZES—
¼"—⅜"—½"—¾" and 1" N.P.T.

Catalog and Engineering Data Sent on Request.



ARROW TOOLS, INC. 1934 S. KOSTNER AVE. CHICAGO 23, ILL.

microflex

RESET TIMER

20 turn dial provides EXACT timing for industrial processes

The double micrometer dial permits 1200 accurate, visual settings over entire dial range. Set this timer for 13 minutes 6 seconds or any other exact time setting required.

Savings

- Large 15 ampere contacts eliminate additional load relays.
- Stop down time with plug-in components for fast timer replacement.

Flexibility

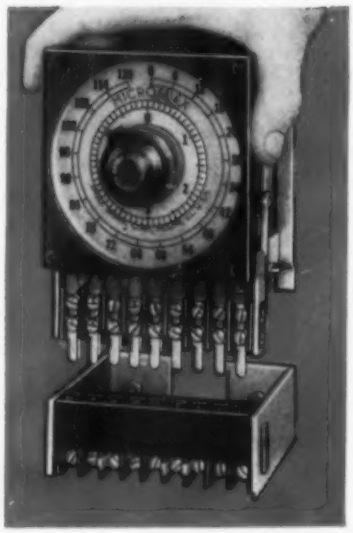
- Easy to set dial whether short or long timing.
- Choice of 9 actions available for each of 3 contacts. Select operation required for your circuit.

Accuracy

- Set dial to exact time required. No guessing at numbers.
- Accurate repeatability insures uniform production.

Reliability

- Proven reliability in thousands of industrial processes for more than 25 years.



Install timer in seconds with optional plug-in feature.

Eagle Timers Save Time — Save Money

EAGLE SIGNAL CORPORATION
Industrial Timers Division
MOLINE, ILLINOIS

EAGLE SIGNAL CORPORATION
Industrial Timers Division, Dept. AH-359
MOLINE, ILLINOIS

Please send FREE Bulletin 110 containing complete data on Microflex Reset Timers.

NAME AND TITLE

COMPANY

ADDRESS

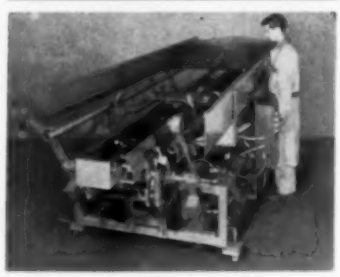
CITY ZONE STATE

BRIEFS

Berea, Ky., installed two large accumulators at the pump. The accumulators keep the system pressure between 2850 and 2950 psi.

Courtesy Parker Hydraulics Div., Parker-Hannifin Corp.

A low pressure system closes the presses. As pressure builds up, the spool in an automatic valve shifts and applies full accumulator pressure to the press. During the curing cycle, the accumulators keep pressure constant by adding fluid to make up for any leakage. □□□



AIR MOTOR gives power for driving the carriage on unloader, transfer and feeder unit. The device handles large stampings and uses air cylinders to position and hold work being fed. Made by Press Automation Systems Inc., Centerline, Mich.

Load Tester for Hydraulic Jacks

Designed for testing repaired jacks this tripod framework will handle 225 tons and will cycle

Continued on page 40

NEW *LOW COST*

DOLLINGER SUMP FILTER

FOR COOLANTS, HYDRAULIC OILS AND LUBRICANTS

Molded End Seals Reduce Cost
. . . eliminate costly machining. Special plastic impervious to all synthetic oils, mild acids, coolants, and water to 300° F.

One Piece Construction
No spare parts necessary. Positive protection against dirt, sludge, rust and abrasive particles causing pump failure.

Exclusive Radial Fin Design
Permits larger filter capacity in smaller area. Mesh screen supplied in 60 or 100 screen depending on efficiency desired and fluid viscosity.

New low price—made possible by a new, simplified filter design.

All new design—As a result of a nationwide study to determine the actual service conditions for sump filters, this new Dollinger Sump Filter was designed. Already, leading hydraulic equipment manufacturers have standardized on this filter for their products. The new design incorporates molded end seals made from a specially formulated plastic impervious to all synthetic oils at temperatures to 300°.

***Eight standard sizes* available. Capacities from 5 to 100 gpm.**
Get complete facts, write for New Sump Filter Catalog 330-H.

DOLLINGER CORPORATION
65 Centre Park, Rochester 3, N.Y.

Please send me your new Sump Filter Catalog 330-H

Name.....

Company.....

Address.....

.....

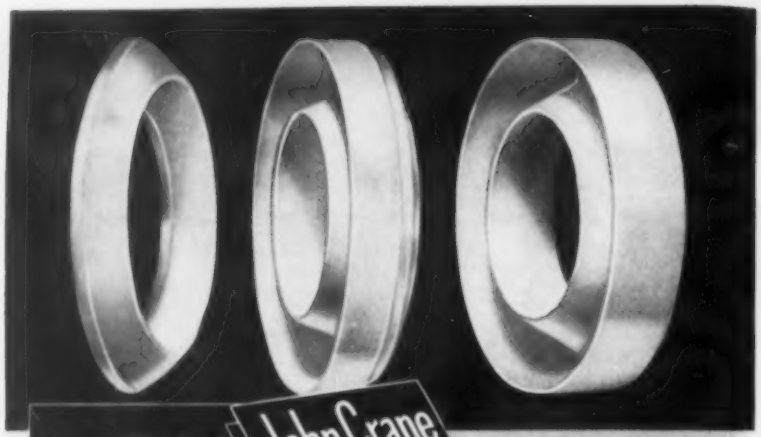
PROTECTOMATIC
STAYNEW FILTERS

DOLLINGER

Specializing in Dry Type Filters for Over 35 Years

Liquid Filters • Pipe Line Filters • Intake Filters • Hydraulic Filters • Electrostatic Filters • Mist Collectors • Dry Panel Filters • Special Design Filters • Viscous Panel Filters • Low Pressure Filters • High Pressure Filters • Automatic Ventilation Filters • Natural Gas Filters • Silencer Filters

Circle **42** *on Time-Saver Card*



John Crane

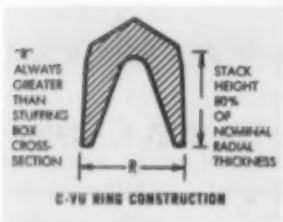
CHEMLON*

C-V RINGS

ARE INDUSTRY'S MOST UNIVERSAL PACKING . . .

Countless successful applications of C-V Rings under the most severe service conditions have made this the closest approach to a universal packing.

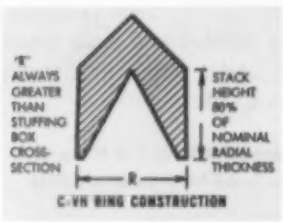
It will effectively handle all industrial acids, alkalis, solvents, organic and hydraulic fluids . . . temperatures from −120°F. to +500°F. . . . is equally suited to valves, pumps, mixers, hydraulic cylinders and like equipment.



"John Crane" C-V Rings have extremely low coefficient of friction. "Breakout" friction is only slightly higher than running friction.

TWO STYLES ARE AVAILABLE:

C-VU RINGS *for low pressure service* —such as control and regulator valves handling gases and fluids, where it is necessary to have a very sensitive and resilient type packing.



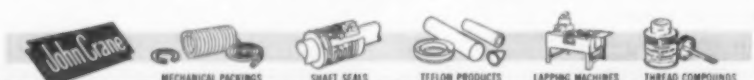
C-VH RINGS *for high pressure service* —for use in pumps, hydraulic cylinders and like services at pressures ranging to 500 psi. and over. These rings are constructed with a heavy wall heel to withstand pressure requirements. They are designed to provide voids between rings, so that as the Teflon expands due to heat, this take-up room minimizes any excess friction in the stuffing box.

"John Crane" C-V Rings are available in full line of standard sizes and male and female adaptors. Sizes can be molded to stuffing box specifications.

Request Bulletin P-325.

*"John Crane" C-V Rings are made from Chemlon—*the best in DuPont Teflon.*

Crane Packing Co., 6405 Oakton St., Morton Grove, Ill. (Chicago Suburb). *In Canada: Crane Packing Co., Ltd., Hamilton, Ont.*



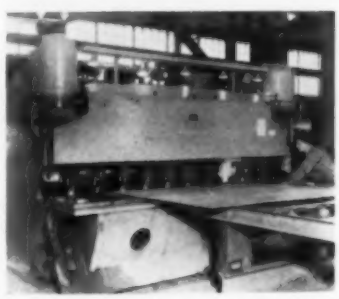
CRANE PACKING COMPANY

BRIEFS

regularly up to 150 tons. Jacks may be cycled at various loads in both directions up to capacity, and bypass valves checked and set. The tester has multiple controls for vernier operation. Large pressure

gages read in psi and tons to assure accurate certification. Designed by Regent Jack Mfg. Co., Downey, Calif. the tester has a clearance of 17 ft 2 in. under the ram. This allows testing of all industrial and aircraft jacks being manufactured. □□□

Continued on page 42



HYDRAULIC SHEAR for ⅜ in. nickel alloy steel gives absolute squareness and holds close tolerance. The sheared plates are used for forming 36 and 48-in. low-temperature pipe. Made by the Pacific Industrial Mfg. Co., Oakland, Calif., the unit has been in operation for 1½ years with no blade sharpening required.

Hose reeling equipment in use at the Mobil Oil Company's Coryton Refinery, is operated with the aid of Keelavite hydraulics.

HYDRAULICS IN MECHANICAL HANDLING

We at Keelavite are a team of experts in the design, installation and maintenance of complete hydraulic systems. We are ready to accept full responsibility for the proper working of all our installations, including all electrical or other control equipment.

Not only this, we are the manufacturers of the largest range of hydraulic units in the United Kingdom.

We are, of course, fully experienced in special applications of hydraulic power for the mechanical handling industry.

KEELAVITE
Hydraulics

MECHANICAL HANDLING DIVISION

THE RECOGNISED AUTHORITY

KEELAVITE HYDRAULICS LIMITED
ALLESLEY, COVENTRY, ENGLAND • Telephone: Meriden 441

Circle **81** *on Time-Saver Card*

585A

March, 1959

ADAMS FACT FILE #2

PLANT AIR

Moisture Chief Cause of Trouble . . .

Every company today is looking for ways to offset the increased costs of labor, material, equipment and services. At a gasoline station you expect "Free Air", but in industry it is a major expense. Perhaps in your own plant, for an investment in a few minor compressed air system alterations, significant savings are possible.

Water, sludge, rust, oil and dirt in compressed air systems are prime causes of maintenance and production down-time. Water vapor condensing in air lines tends to corrode the piping. Also, water present in the piping may freeze during winter, causing serious reduction of compressed air supply. Such restrictions are often difficult to locate and thaw. This same line moisture may emulsify lube oil destroying its lubricating value and the resultant mixture has high fouling characteristics. Frequently, ice will form within the tool itself since expanding air cools the moisture . . . tool efficiency will be seriously affected.

Some of the Other Problems Created By Wet Compressed Air . . .

Wet compressed air is not only a construction and production tool problem. Faulty paint jobs, contaminated chemical and food products can often be traced to moisture laden compressed air. Waterhammer, unequal pipeline thermal expansion and line leaks also result from collected moisture. In addition, air lost through traps, and in blow-down of compressed air lines provide no useful work . . . represent a sizeable power loss.

You Can Lick Compressed Air Moisture Problem . . .

All of these hidden costs can be virtually eliminated by the installation of an Adams Aftercooler and Cyclone Separator between the compressor and receiver tank. By cooling discharge air to within 10° F. of cooling water temperature — guaranteed with Adams standard Aftercoolers — the moisture can be removed at the separator. Pressure loss is less than one-half pound on these units including the separator. In severe cases, moisture removal of over 90 per cent can be obtained by cooling the air with Adams 2° Aftercooler to within 2° F. of water temperature.

Air Filter for Final Protection at Point of Use . . .

As an added safeguard for expensive tools and equipment, an Adams Poro-Stone Air Filter should be installed just before the air is used. These filters remove all solid material picked up by the air stream. With an Adams Aftercooler, Cyclone Separator and Air Filters clean, dry, trouble-free air is supplied to your production tools. You get continuous service with minimum maintenance.

For further information on how the complete line of Adams air equipment can solve your compressed air problems, write today for your free copy of Bulletin No. 712 on Aftercoolers and Bulletin No. 117 on Poro-Stone Air Filters from the R. P. Adams Company, Inc., 249 East Park Drive, Buffalo 17, New York.

Circle **3** *on Time-Saver Card*

BRIEFS

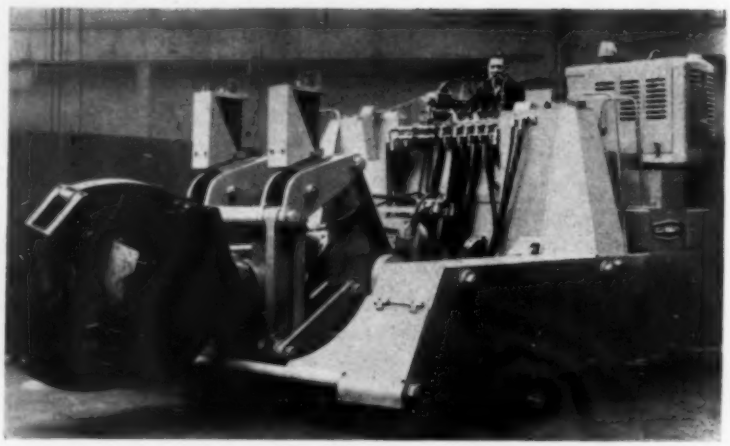
New Books

Basic Hydraulics by Walter J. Sharrock & Robert S. Smilges, project engineers, Denison Engineering Division, American Brake Shoe Co., for Ohio Trade and Industrial Education Service, 95 pp, price $2.00, from Merle E. Strong, Instructional Materials Laboratory, 112 Townshend Hall, Ohio State University, Columbus, Ohio.

A training manual for maintenance men. It has 25 assignments ranging from review of basic mathematics to circuit diagram exercises. Simple methods and formulas for figuring component sizes are given. Fire-resist-

Continued on page 46

FORGING MANIPULATOR IS ALL HYDRAULIC POWERED



Machine has a capacity of 8000 lbs and features side movement of the tongs 12 inches each side of center. Hydraulic power is supplied by two pumps driven through V-belts from a diesel engine. One is variable delivery and powers the traction motor up to ¼ full speed and the hydraulic steering. The other pump is a fixed delivery, gear type which powers all motions of the head, the traction motor to top speed, and the hydraulic brakes. This pump is automatically unloaded when the system reaches operating pressure. Two hydraulic accumulators are used in this circuit for unloading and shock absorbing.

Except for the brakes all operations are controlled from one multiple valve block. Forward and reverse are foot controlled, steering and head movement are hand operated. A steering valve is incorporated in the valve block.

Braking is controlled by a foot-operated directional valve through an intensifier which builds up pressure to 3000 psi.

Feedback from the steering gears to the steering valve closes the valve when the wheels have moved the required amount.

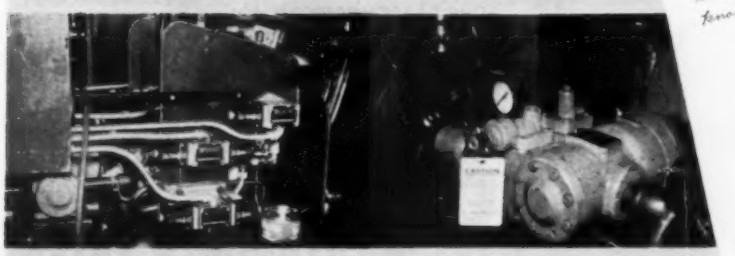
All movements of the head except rotation are controlled by double-acting cylinders operated from the multiple valve. Tongs are rotated by a heavy-duty gear motor. A deceleration valve is used in this circuit. Traction motor is identical to the rotation motor and pump. A deceleration valve is also used to protect the traction motor.

Oil is filtered through two sets of .005 inch filters mounted in the 100-gal reservoir. A micronic filter is included in the outlet line of the variable-volume pump.

Unit was built by Head Wrightson Ltd., Middlesborough, England, under license from Salem Brosius Inc., Pittsburgh, Pa. Hydraulic components were supplied by Keelavite Hydraulics Ltd., Coventry, England. □□□

"thank you ... for my husband's life"!

"If Mel had used oil (which is commonly employed) in the hydraulic lines he would have been enveloped by a blazing inferno! But thank God! *Houghto-Safe* was in the lines!"



"Mel was standing here at time of 'blow-up'." Fluid still dripping from lines when photo was taken.

Pump with Houghto-Safe fill tag. Faulty fitting was at right of motor.

DO YOUR MEN HAVE THIS PROTECTION?

Why take chances in your own shop, if men are working around hot metal, open flames, or other high temperature hazards? Even under low pressures, hydraulic fluid can spray up to 40 feet if a line breaks. You need Houghto-Safe protection! And with Houghto-Safe protection, you get top hydraulic efficiency and better-than-ever protection against pump wear.

Now's the time to protect your plant and personnel from disastrous explosions and fire. Call your Houghton Man today. Or write E. F. Houghton & Co., 303 W. Lehigh Ave., Phila. 33, Pa.

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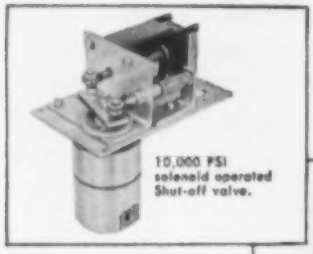
PHILADELPHIA • CHICAGO • DETROIT • SAN FRANCISCO • TORONTO

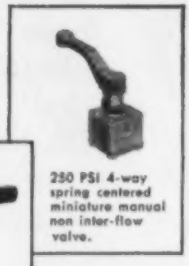
Ready to give you on-the-job service

YOUR **SPECIAL** VALVE

MAY ALREADY BE **IN PRODUCTION**



10,000 PSI solenoid operated Shut-off valve.



250 PSI 4-way spring centered miniature manual non inter-flow valve.

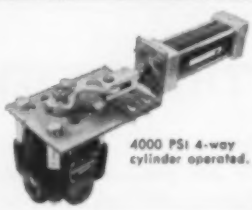
3000 PSI 3-way explosion-proof solenoid valve with manual override.

3000 PSI inline manual shut-off valve.

3000 PSI Dual 3-way, 3-position manual non inter-flow valve.

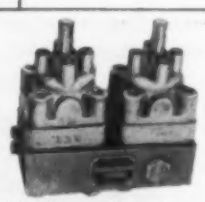
3000 PSI 4-way non inter-flow manual valve built to military specifications.

1500 PSI 4-way spring centered manual valve with built in cylinder relief and pressure relief valves.



4000 PSI 4-way cylinder operated.

1500 PSI 4-way spring centered manual valve with built in cylinder relief valve.



1500 PSI manifold mounted manual valves on a sub base with built in check and relief valves.

The Barksdale valves shown on this page represent some of the over 1000 typical examples of modifications developed for the special requirements of original equipment manufacturers.

We are interested in "Specials" and can produce them economically, because the "Shear-Seal" design is exceptionally adaptable.

If you have a special valve requirement, call your Barksdale representative and ask to see the scores of existing modifications in Special Valve Catalog SV-158 and Remote Control Catalog RV-958, or write and outline your special requirements to:

CONTROL VALVE DIVISION

Barksdale valves

5125 ALCOA AVENUE • LOS ANGELES 58 • CALIFORNIA

TO FIND THE BARKSDALE REPRESENTATIVE IN YOUR AREA LOOK UNDER "VALVES" IN THE CLASSIFIED SECTION OF THE FOLLOWING PHONE BOOKS:

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Indiana, Indianapolis
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Maryland, Baltimore
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Michigan, Detroit
Minnesota, Minneapolis
St. Paul
Missouri, St. Louis
Kansas City
New Jersey, Jersey City
New York, Buffalo
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Cleveland
Oklahoma, Tulsa
Oregon, Portland
Pennsylvania, Philadelphia
Pittsburgh
Tennessee, Memphis
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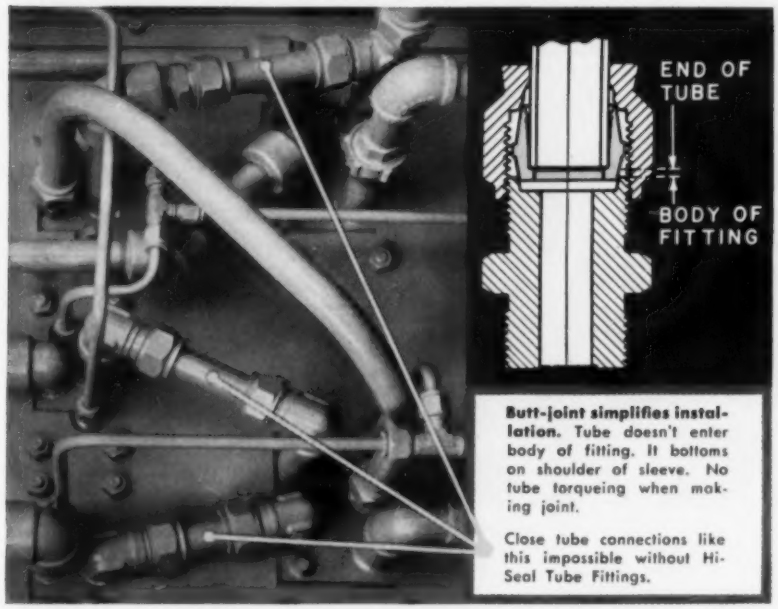
El Paso
Houston
Washington, Seattle
Wisconsin, Milwaukee

IMPERIAL Engineering and Data File

ENGINEERED TUBE FITTINGS — VALVES — TUBING TOOLS



Butt-joint simplifies installation. Tube doesn't enter body of fitting. It bottoms on shoulder of sleeve. No tube torqueing when making joint.

Close tube connections like this impossible without Hi-Seal Tube Fittings.

Far more compact hydraulic piping layout made possible by Hi-Seal butt-joint tube fittings

This hydraulic power unit built by Scott Equipment Company, Dayton, Ohio, shows how Hi-Seal flareless tube fittings create new piping design opportunities.

Because of Hi-Seal's *positive butt-joint feature* which requires no tube entry into fitting, Imperial Hi-Seal makes possible far more compact piping layouts than would be obtained with other fittings. In addition the butt-joint design eliminates the need to spring tubing . . . a big advantage when working with large-diameter, heavy-wall or hard-temper tubing.

Important, too, there is only one way to put the Hi-Seal fitting together. No chance of sleeve being put in backward. And Hi-Seal fittings can be disconnected and reconnected as often as desired with assurance of original pressure-tight seal! It's the ideal fitting for hydraulic and other services where higher pressures are encountered. Meets J.I.C. and A.S.M.E. Standards. Available in Steel, Stainless Steel and Brass.

Write for Bulletin No. 3061

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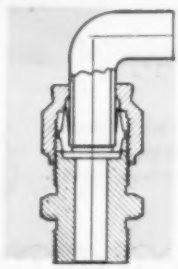
Limited space no problem for Hi-Seal fittings

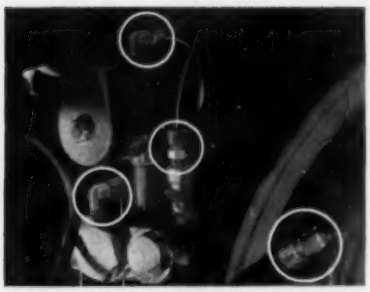


Because no flaring is necessary, and because of its butt joint, this fitting permits bends to be made exceptionally close to the end of the tubing . . . a major design advantage where space is limited.

IMPERIAL

THE IMPERIAL BRASS MFG. CO.
6300 W. Howard St., Chicago 48, Illinois
In Canada: 18 Hook Ave., Toronto, Ontario

Make huge time and labor savings with Poly-Flo tube fittings



New Lindsay All-Automatic Water Softeners employ Imperial Poly-Flo tube fittings and polyethylene tubing in the saturated brine lines in recharging these water softeners.

It is in units like this that Imperial Poly-Flo fittings make possible big savings in time and money. Polyethylene tubing bends readily by hand. No mechanical flaring or bending. Fittings need only be finger-tightened. Wrenches or other tools are never necessary.

Imperial Poly-Flo tube fittings hold burst pressure of polyethylene tubing and are ideal for applications involving conduction of most types of gases and liquids.

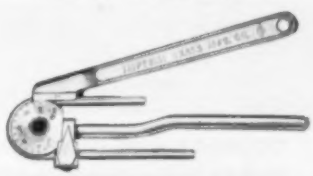
Write for Bulletin No. 3025

• • • • • •

Tube Bender for hard or soft tubing

Bend hard and soft drawn copper, steel, aluminum, thinwall conduit; even stainless steel tubing. Won't mar or flatten tubing. Calibrated for bending any angle to 180°. Sizes for ⅛" to ⅞" O. D. Tubing.

Write for Bulletin No. 3088



CONTACT YOUR INDUSTRIAL DISTRIBUTOR OR WRITE TO:

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Chicago 48, Ill.
Please rush me:
Bulletins ☐ No. 3061 ☐ No. 3025 ☐ No. 3088
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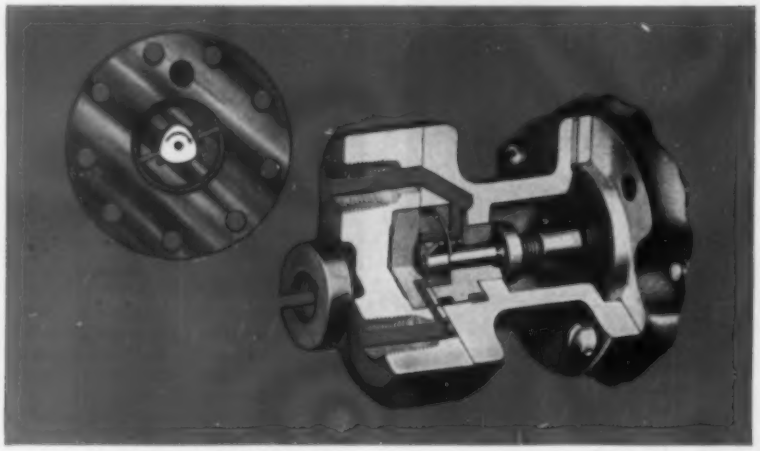
City ..... Zone ..... State .....

Circle **77** on Time-Saver Card

VESTERDAY'S PIONEER . . . TODAY'S LEADER

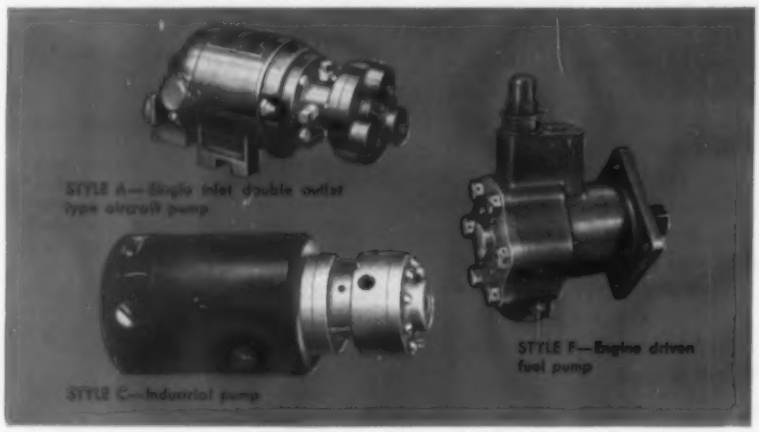
WELDON / FLUID METERING PUMPS

Positive Displacement Rotor Type. For Industrial Applications, Aircraft Anti-Icing and Aircraft Fuel.



IT'S SO SIMPLE!

The rotation of the rotor draws the fluid in through two passages, filling the cavities formed by the three lobes of the rotor. This fluid is sealed within these small cavities until it is forced through the two outlet holes by the floating blades. The flow may be kept uniformly divided through two outlet ports, or may be combined internally for passage through a single port.



COMPACT • LIGHT WEIGHT

Send for Weldon Manual and Catalog with detailed specifications and installation drawings, covering the full range of Weldon pumps in various capacities. Specify your requirements.

40 YEARS OF LEADERSHIP 1918—1958

THE WELDON TOOL COMPANY

3000 WOODHILL ROAD . . . CLEVELAND 4, OHIO

Circle **152** on Time-Saver Card

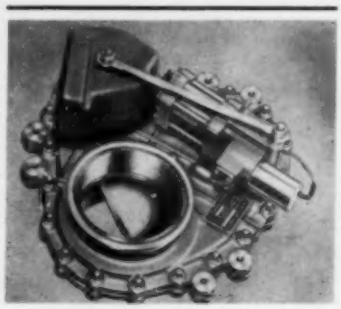
BRIEFS

ant fluids, their properties and recommended seals are covered. Each assignment is followed by questions to be answered by the reader.

Fluid-Power Controls by John J. Pippenger and Richard M. Koff, 252 pp, price $9.00, McGraw-Hill Book Co., Inc., New York, N. Y.

A practical guidebook on controls for fluid power systems. It describes their construction, operation, and maintenance. Covered are valves, pumps, piping, and circuits.

Schematic drawings are blended with cut-aways to explain construction of components. JIC and ASA standards and symbols are given. There is a complete glossary of terms for designers, purchasing agents, and component manufacturers. □□□



GATE VALVES for handling liquid oxygen are actuated by air or hydraulic cylinders. They are used as fill valves with pressures to 60 psi and ambient temperatures from —320 to 250 F. Valves can also be used for aircraft or missile fuels. Designed by Koehler Aircraft Products Co., Dayton, Ohio.

Hydraulic Motors Synchronize Paper Calender

A large paper manufacturer has improved production by using a constant tension, synchronized, hydraulic winder drive on a paper calender. Synchronization is as-

Continued on page 48

1. Bronze Bearing, with self-adjusting "U" Cup Piston Rod Seal for longer wear.
2. Rod Wiper protects Piston Rod Seal and keeps Cylinder clean.
3. "U" Cup Seals expand with pressure to provide positive seal with minimum friction.
4. Wrench Flats make for easy installation.
5. Ground, hard chrome-plated Piston Rods have minimum yield strength of 125,000 psi.
6. Self-locking cushion adjusting screw and ball check are below surface for protection . . . easily accessible.
7. For extra strength, Cylinder Ends and Mounting Plates are machined from bar stock and steel forgings.
8. Cylinder is precision-finished brass for extra heavy duty.
9. Variety of mountings can be interchanged—easily match any installation requirement.
10. Interchangeable with all JIC Cylinders.

SCHRADER SQUARE-END CYLINDERS

meet and exceed JIC specs . . . 250 psi air . . . 750 psi hydraulic!

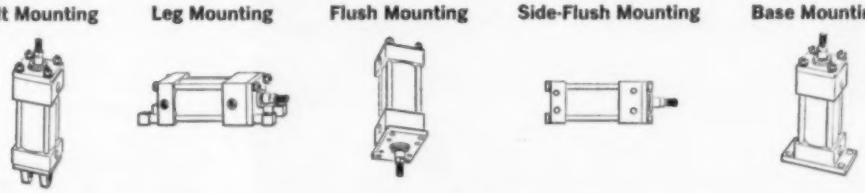
Here's compact, versatile straight-line power. Just look at the features!

Use Schrader's new square-end double-acting cylinders for holding, positioning, moving work—for push, pull or lifting—for automating manual operations. In five sizes up to 4-inch bore, and with five interchangeable mountings, these "square-ends" are economical and versatile. Bolt, leg, flush, side flush or base . . . each JIC Cylinder will mount all five ways. Suitable for air pressures to 250 psi, or hydraulically to 750 psi—available cushioned or non-cushioned.

You get safe, controlled, low-cost power with Schrader "square-ends"—another addition to the line of famous Schrader quality Air Control Products.

Complete stocks available locally—expert help to improve your air control hookups. Write for your complete specifications and data on these new "square-ends."

Bolt Mounting **Leg Mounting** **Flush Mounting** **Side-Flush Mounting** **Base Mounting**



Schrader
a division of SCOVILL

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QUALITY AIR CONTROL PRODUCTS

for increased production . . .
minimum down-time . . .
lower costs . . . specify

SP

AIR and HYDRAULIC CYLINDERS

SERIES A

Rated 200 psi air and up to 500 psi oil or water, 23 mounting types. Corrosion-resistant, precision-honed, hi-tensile brass tube.

SERIES H

Rated 2,000 psi hydraulic. Complete range of mounting types. Precision-honed seamless steel tube.

- floating cushions—uniform cushioning—long life—fully adjustable
- easily removed cartridge-type rod seals with integral rod wiper
- choice of rod sizes for all applications—rods heat-treated and hard chrome plated for resistance to nicking and scoring
- steel heads and end plates for strength and positive alignment
- all ferrous parts rust-proofed

Before you buy any cylinder, consider the quality design and construction features of S-P air and hydraulic cylinders—features that will assure dependable performance . . . long service life . . . minimum down-time . . . lowest end cost.

What's *your* cylinder problem? We'd like to help you solve it—a phone call will bring our representative on the double. Prompt deliveries, too. The S-P Manufacturing Corporation, 30201 Aurora Road, Solon, Ohio.

SP for speed and performance

Representatives in principal cities. Phone or write for Catalogs No. 110B (Series A) and No. 104A (Series H).

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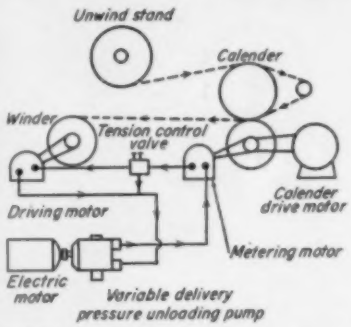
A BASSETT COMPANY • IN GREATER CLEVELAND • ESTABLISHED 1916

AA-7487

BRIEFS

sured by series-driving the hydraulic winder motor from the calender metering motor without drawing any power from the existing calender drive source.

A variable-displacement pump driven by a constant speed electric motor, delivers only the required volume to the constant-displacement motor connected to the calender drive. This motor serves as a meter for the system. The volume requirements of the metering motor are directly proportional to the speed of the calender



DISCHARGE FROM metering motor powers drive motor. This keeps a direct speed relationship between the two.

drive. The pump control automatically changes the pump delivery to the exact amount needed by the metering motor, conserving input power.

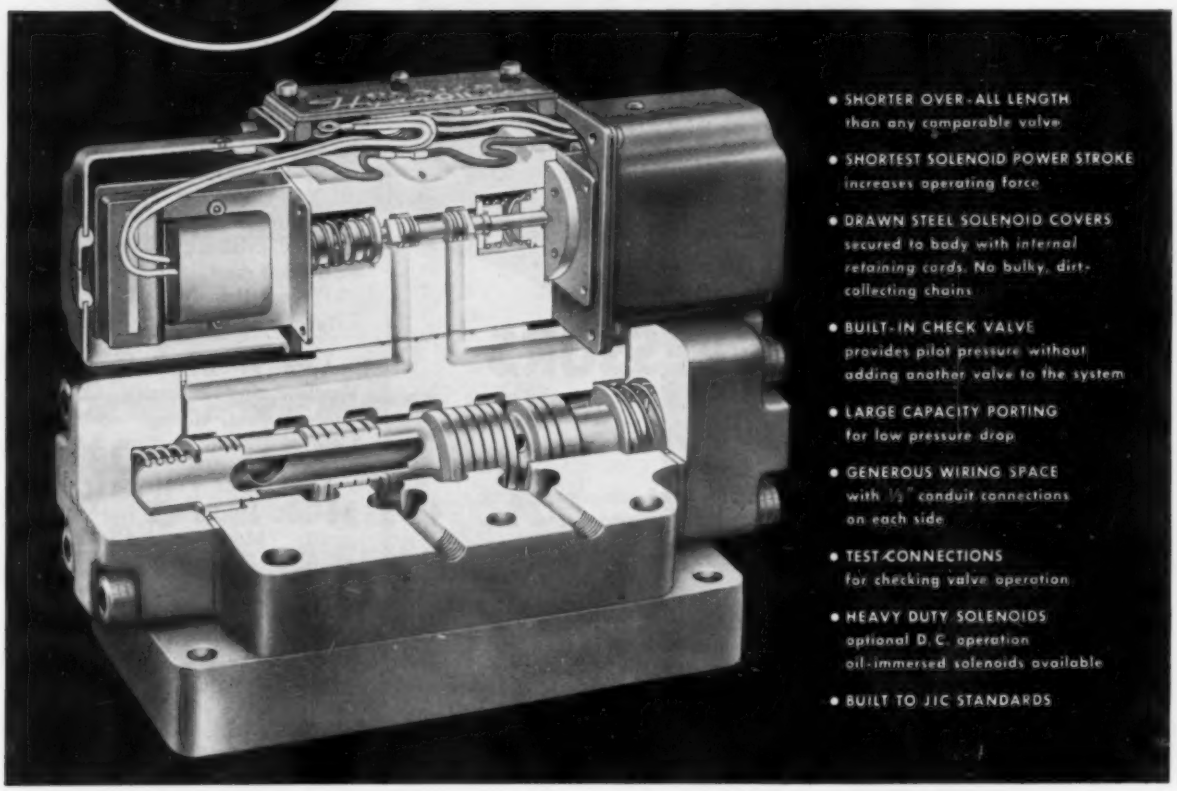
Oil delivered by the metering motor flows directly to the constant displacement motor driving the winder. Hence, the speed of the winder drive motor is always directly related to the speed of the metering motor, from zero to maximum.

When starting a new winder core no oil is bypassed through the winder tension valve. As the winder roll diameter and torque (pressure) increases, the tension valve automatically bypasses an increasing amount of oil delivered by the metering motor. Therefore, the winder motor and winder roll slow down automatically maintaining proper paper tension. The drive was designed by The Oilgear Co., Milwaukee, Wis. □□□

NEW from DENISON

4-WAY VALVES

Pilot-operated, solenoid-controlled for hydraulic systems up to 5000 psi



- SHORTER OVER-ALL LENGTH than any comparable valve
- SHORTEST SOLENOID POWER STROKE increases operating force
- DRAWN STEEL SOLENOID COVERS secured to body with internal retaining cards. No bulky, dirt-collecting chains
- BUILT-IN CHECK VALVE provides pilot pressure without adding another valve to the system
- LARGE CAPACITY PORTING for low pressure drop
- GENEROUS WIRING SPACE with ½" conduit connections on each side
- TEST CONNECTIONS for checking valve operation
- HEAVY DUTY SOLENOIDS optional D.C. operation oil-immersed solenoids available
- BUILT TO JIC STANDARDS

SHOCKLESS HYDRAULIC CONTROL for any directional control requirement is assured with Denison's new line of 4-Way Valves.

Here are *more reasons why* the exceptional design versatility of these new 4-Way Valves is important to Hydraulic Engineers—

1. Provide fast, rapid-cycle directional control of hydraulic flows up to 30 gpm.
2. Operating pressures range up to 5000 psi for both ¼" and ¾" valve sizes.
3. Operate in any porting and positioning combination.
4. Solenoid-operated ¼" valve capacity—5 gpm.
5. Pilot-operated, solenoid-controlled ¾" valve capacity—30 gpm.
6. Choice of spool types and spool positioning provides unlimited combinations for a wide range of applications.
7. Adjustable pilot chokes available for smooth spool reversal.
8. Interchangeable parts simplify service and model changes in the field.
9. Easily modified for operation on internal or external pilot pressure by rotating solenoid valve 180°.

DESIGNERS ENGINEERS!

Send for Bulletins VD-7, VD-8 and 240-B

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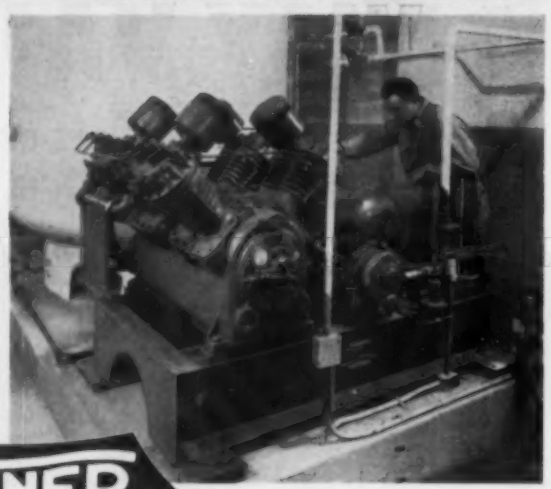
HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

CONTROL MANUFACTURERS



Typical installation shows Brunner compressors providing a dependable source of compressed air for operating pneumatic control of the large air conditioning system in New York's Socony Mobil Building.

PREFER

BRUNNER
SINCE 1906

AIR COMPRESSORS
for 6 good reasons

Looking for a reliable, economical source of compressed air? Take a tip from leading control manufacturers who prefer and select Brunner air compressors.
They'll tell you . . . BRUNNER Air Compressors

- Are outstandingly dependable
- Provide oil and moisture free air
- Offer single or 2 stage equipment in all sizes
- Supply complete air or water cooled aftercooler assemblies with all fittings from one dependable source for all compressor sizes
- Provide "entire system" duplex units that are "operation readied" to connect to piping and wiring facilities
- Air conditioning and heating experience of Dunham-Bush engineers enables them to professionally assist in layout for dependable control systems.

ALSO WATER COOLED AFTERCOOLERS AND OTHER ACCESSORIES BY heat-x A DUNHAM-BUSH SUBSIDIARY

WRITE FOR NEW BRUNNER AIR COMPRESSOR CATALOGS

You'll find full information on the use of compressed air; data that indicates the right compressor for a specific job; tables of computations for correct installation.
Ask for Catalog #36 for a guide to ½ through 20 H.P. Brunner Air Compressors.
For Brunner 25-30-40-50 H.P. industrial air compressor data, ask for catalog #37.

BRUNNER DIVISION

DUNHAM-BUSH, INC.

DEPT. AA. WEST HARTFORD 10, CONNECTICUT

Circle **44** *on Time-Saver Card*

FUTURE EVENTS

March 19-20: SAE National Production Meeting. The Sheraton - Cadillac Hotel, Detroit, Mich.

March 31-April 3: SAE National Aeronautic Meeting, Aeronautic Production Forum, and Aircraft Engineering Display. Hotel Commodore, New York, N. Y.

April 5-10: ISA Nuclear Congress, Cleveland, Ohio. For information contact Dr. S. Baron, 160 West Broadway, New York City.

April 14-15: Tenth Annual Earthmoving Industry Conference. Peoria, Ill. Sponsored by Central Illinois Section, SAE.

April 27-May 1st: SAE A-6 Aircraft Hydraulic and Pneumatic Meetings, Cleveland, Ohio.

May 15-18: Annual Spring Meeting, National Fluid Power Association, Grove Park Inn, Asheville, N. C.

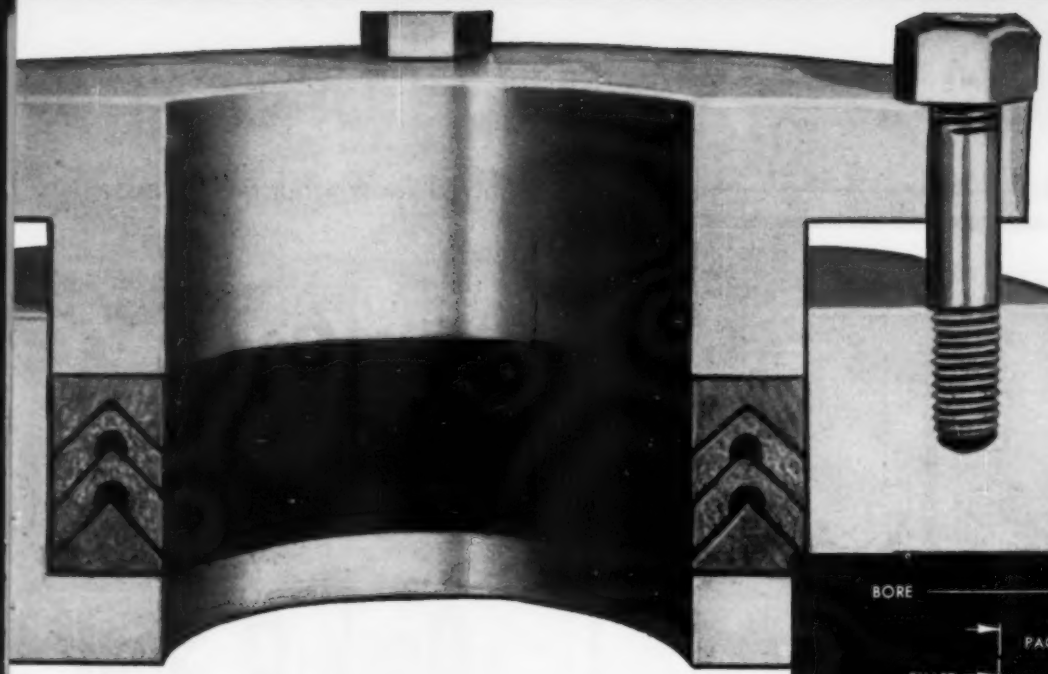
May 25-28: Annual Design Engineering Show, Convention Hall, Philadelphia, Pa.

September 14-17: National Farm, Construction, and Industrial Machinery Meeting, Production Forum, and Display. The Ambassador, Los Angeles, Calif.

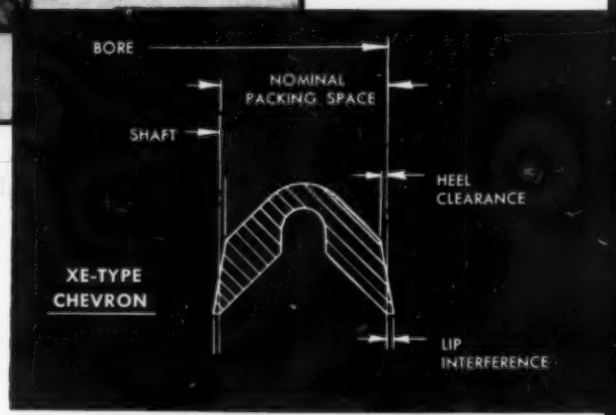
September 21-25: ISA 14th Annual Instrument-Automation Conference Exhibit, International Amphitheatre, Chicago, Ill.

October 5-10: SAE National Aeronautic Meeting, Aircraft Manufacturing Forum, and Aircraft Engineering Display. The Ambassador, Los Angeles, Calif.

October 26-28: Annual Fall Meeting, National Fluid Power Association, Statler Hotel, Detroit, Mich.



MORE ABOUT THE GARLOCK 2,000



HOW LIP INTERFERENCE AND HEEL CLEARANCE IMPROVE CHEVRON* PACKING DESIGN

There are many reasons why users prefer famous Garlock CHEVRON Packings for sealing rams or rods on hydraulic systems. Design refinements indicated in the drawing above are just two examples:

Heel clearance for easy installation. Experience has shown that unless adequate clearance is provided at the heel of a V-type packing ring it can be very difficult to insert in the stuffing box. The heel clearance on Garlock CHEVRON Rings has proved to be the ideal for easy installation without disturbing the unique advantages of the CHEVRON design.

Lip interference for sealing at low pressures. If the lip of a V-type packing is made exactly to nominal size, and all the clearance taken at the heel, leakage past the lip often occurs at low or zero pressures. On the other hand, too much interference at the lip generates excessive friction resulting in scoring and wear. The lip interference on Garlock CHEVRON Packing is your assurance of minimum friction and positive sealing at all pressures.

There are many other design advantages of Garlock CHEVRON including its hinge-like construction which automatically compensates for pressure changes. If you have a sealing problem involving lubricants, liquids, or solvents at temperatures ranging from −320°F to +600°F, why not find out more about the many forms of Garlock CHEVRON Packings available.

CHEVRON Packings are another important part of the Garlock 2,000 . . . two thousand different styles of packings, gaskets, and seals for all your needs. Call your local Garlock representative or write for Folder AD-115.

*Registered Trade Mark

THE GARLOCK PACKING COMPANY, Palmyra, N. Y.

For Prompt Service, contact one of our 30 sales offices and warehouses throughout the U. S. and Canada.

GARLOCK

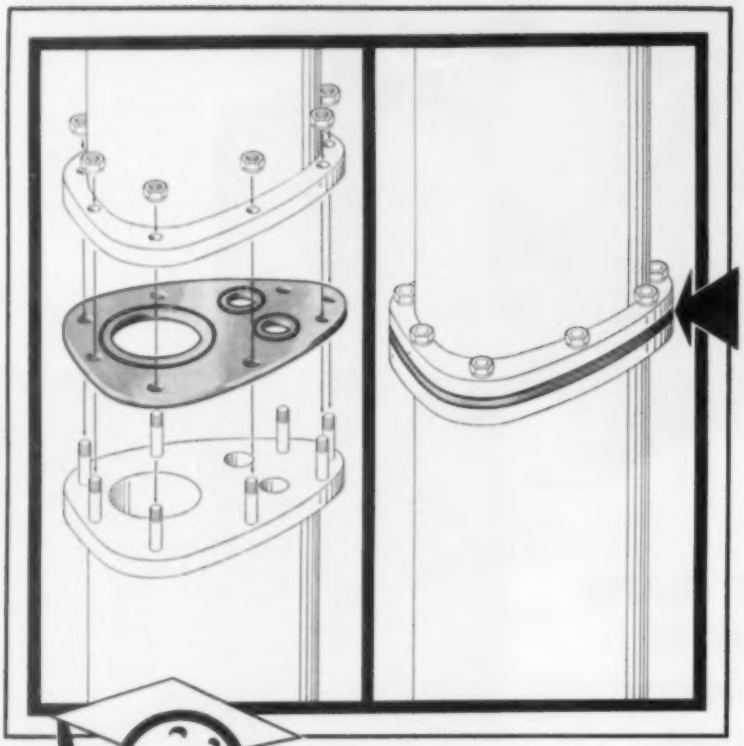
Packings, Gaskets, Oil Seals, Mechanical Seals, Molded and Extruded Rubber, Plastic Products

Canadian Division: The Garlock Packing Co. of Canada Ltd.

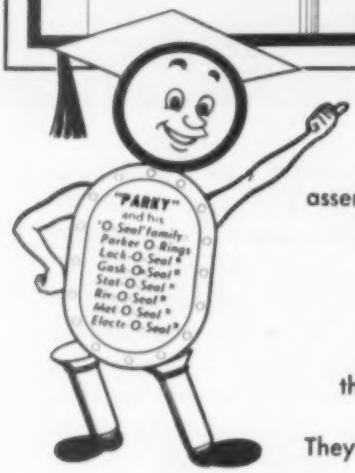
Plastics Division: United States Gasket Company

Circle **57** on Time-Saver Card

DO YOU KNOW ABOUT GASK-O-SEALS?

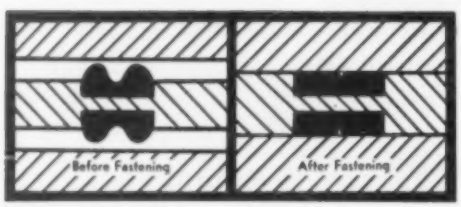


You Can't leave a Gask-O-Seal® out!



Hundreds of accidents have been caused by seals being left out during assembly or repair, and thousands of production hours have also been lost for the same reason. Just one of the plus values of Gask-O-Seals is that they are practically impossible to leave out because they are inspectable visually after assembly. This can mean many valuable warranty dollars saved, many hours of downtime saved — and it may mean the saving of human lives.

They also provide no-leakage positive sealing, prevent blow-outs. Damaging coldflow is eliminated, high manufacturing and maintenance machining costs are avoided and they are reuseable. If you use static seals in your designs, why not find out about Gask-O-Seals — made by the makers of Parker O-rings.



Parker SEAL COMPANY
CULVER CITY, CALIFORNIA and CLEVELAND, OHIO
A DIVISION OF PARKER-HANNIFIN CORPORATION

Circle **111** on Time-Saver Card

VICKERS® OIL HYDRAULICS

BUILT AROUND THE WORLD

THESE NAMEPLATES MEAN WORLD-WIDE AVAILABILITY OF SERVICE, PARTS AND UNITS OF CONSISTENT QUALITY

When you use Vickers hydraulics, you can send your machinery almost anywhere in the free world with assurance that consistent quality service units will be available.

Vickers manufacturing facilities, as indicated by the nameplates above, are strategically located convenient to industrial centers around the world. Vickers consistent quality and parts interchangeability are maintained through a systematic program of inspection and test by the parent organization. Any component built in one plant will be compatible with components and systems from all other plants.

These are added advantages to you when you specify Vickers hydraulics on your machinery for export or for your machinery built overseas.

FOR FURTHER INFORMATION PLEASE WRITE FOR BULLETIN 5500

VICKERS INCORPORATED
Division of Sperry Rand Corporation
INTERNATIONAL DIVISION
Administrative & Engineering Center
Detroit 32, Michigan

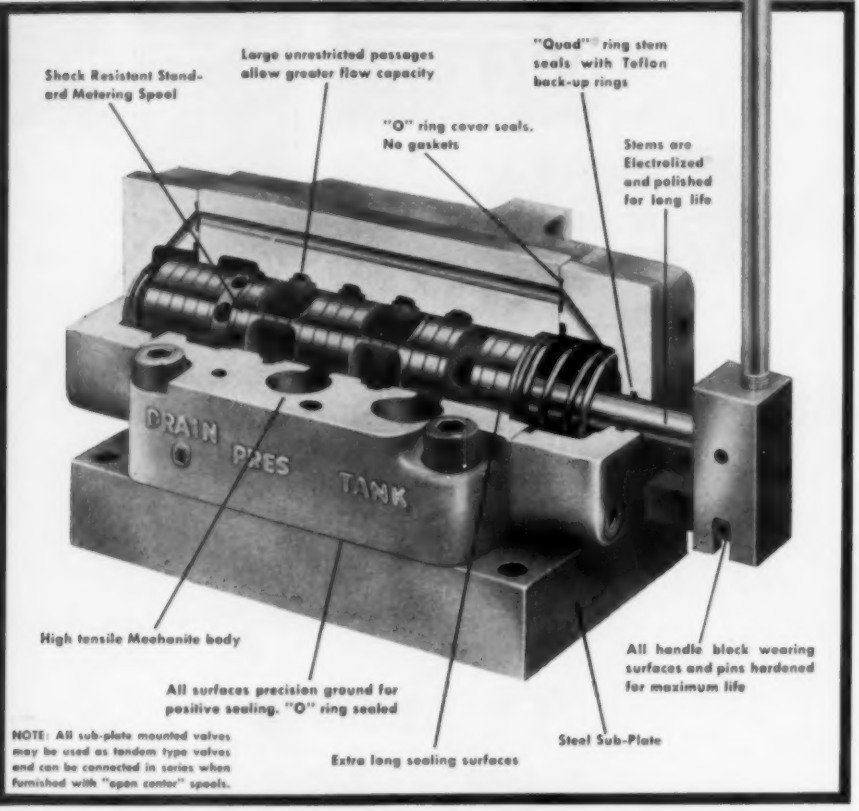
8045

Manufacturing, Sales and Service in: AUSTRALIA • CANADA • ENGLAND • GERMANY • JAPAN • UNITED STATES
Sales and Service in: BELGIUM • BRAZIL • DENMARK • FINLAND • FRANCE • HAWAII • ITALY • NEW ZEALAND • NORWAY • SOUTH AFRICA • SPAIN • SWEDEN

Rivett announces a new line of

HYDRAULIC VALVES

3000 PSI; sub-plate mounted; manually operated


Shock Resistant Standard Metering Spool
Large unrestricted passages allow greater flow capacity
"Quad" ring stem seals with Teflon back-up rings
"O" ring cover seals. No gaskets
Stems are Electrolized and polished for long life
DRAIN
PRES
TANK
High tensile Meehanite body
All surfaces precision ground for positive sealing. "O" ring sealed
All handle block wearing surfaces and pins hardened for maximum life
Steel Sub-Plate
Extra long sealing surfaces
NOTE: All sub-plate mounted valves may be used as tandem type valves and can be connected in series when furnished with "open center" spools.

Reliable performance through precision manufacturing

Rivett Series 6100 Hydraulic Valves are the latest in design, furnishing accurate, positive control of hydraulic power. Developed by engineers long experienced in fluid power, these valves offer economical, efficient operation as well as trouble-free maintenance and long-life. Featuring unrestricted passages to permit greater flow capacity, the 1" size in the Series 6100, for example, is rated at 28.2 gpm at 15 ft. per sec. Piston action is noted for smooth, positive opening and closing.

New catalog simplifies selection and ordering

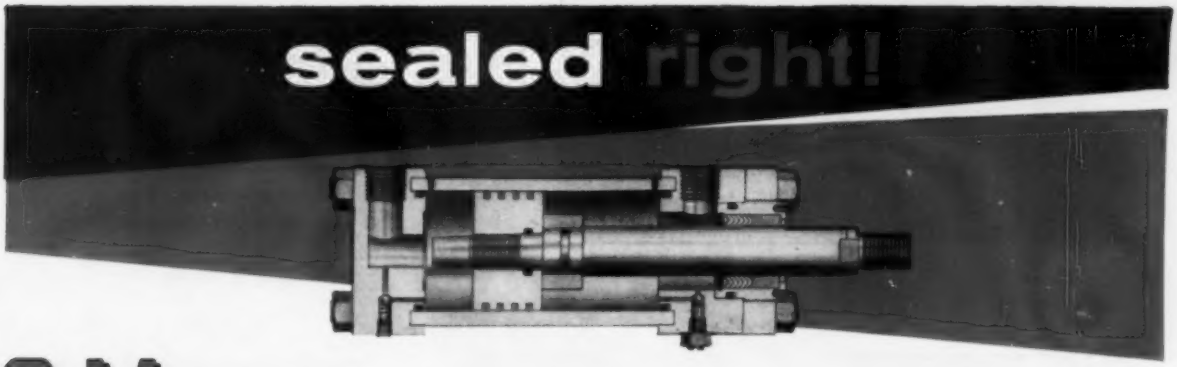
Rivett's new easy-to-use Valve Catalog No. 210 puts complete information on performance, ratings, dimensions, mountings and ordering instructions at your finger tips. Write today for your copy of Catalog No. 210.

The better you know hydraulics . . . the better you like →

RIVETT, INCORPORATED, DEPT. AH-3
Brighton 35, Boston, Massachusetts
Member National Fluid Power Association

RIVETT
HYDRAULIC VALVES

sealed right!



O-M Heavy-Duty Series TH Hydraulic (Oil) Cylinders

IF you are experiencing difficulty with leakage through the seals and packings of the cylinders you have been using, the O-M "TH" Series Heavy Duty Hydraulic cylinders may be the answer to your problem. Since their introduction in 1955 these cylinders have established an enviable reputation for efficient and trouble-free service.

The O-M Series TH Cylinders are Designed Right to Seal Right. Prior to the design of these cylinders, many tests were made and field experiences were surveyed to find the most efficient way to eliminate the old "leakage problem".

Homogeneous "O" rings, with their elastic characteristics, cannot be excelled as static seals when backed-up with plasticized leather non-extrusion rings and installed in a properly designed cavity.

Ring-type piston packings are excellent for long-life and trouble-free performance when a small amount of piston by-pass is permissible. When by-pass is not allowable, "Vee-type" packings similar to those used as standard in the rod gland provide optimum sealing. The "Vee-type" packing is self adjusting and provides multiple lip sealing with excellent pressure sensitivity and long life.

The homogeneous "lip-type" rod wiper or the metallic scraper (your choice) is located well forward so as to prevent dirt from accumulating and scoring the piston rod and damaging the bearing and packing.

O-M Series TH Cylinders are "Designed Right" and "Sealed Right". Available in 1½" to 8" bores with complete selection of mountings. Mail coupon TODAY for Bulletin No. 105 showing description drawings of cylinders mountings and capacity chart.

ORTMAN-MILLER MACHINE COMPANY
1 143rd Street, Hammond, Indiana

☐ Have representative call
☐ Send Bulletin 105

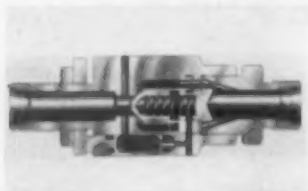
Name_____ Position_____
Company_____
Address_____
City_____ Zone____ State_____

Circle **106** *on Time-Saver Card*

NEW PRODUCTS

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

IN-LINE RELIEF VALVE
. . . has high flow rate



Features: For high pressures, flows, and temperatures. Adjusted by turning the external adjusting nuts without disconnecting piping. Free flow in reverse direction. Pilot operation gives high flows. Only one O-ring seals valve.
Specifications: Made with flareless or 37° flare in accordance with MS 33656 or MS 33514. Stainless steel construction. Temperatures to 400 F. Tube sizes 8 and 12.

Republic Mfg. Co.
Cleveland, Ohio
Circle **300** on Time-Saver Card

AIR & OIL CYLINDERS
. . . have 21 mounting styles

Designation: Series A
Features: Rust-proofed ferrus parts. Hard-chrome plated piston rods.

Micro-honed brass barrels. Large ports for fast response. All components stocked for fast delivery.
Specifications: For 200 psi air and 500 psi oil or water. Block-vee piston seals and removable cartridge rod seals. Temperatures —20 to 150 F.

S-P Mfg. Corp.
Solon, Ohio
Circle **301** on Time-Saver Card

PRESSURE CONVERTER
. . . for gages & pressure switches

Designation: Econ-o-gage
Features: Reduces line pressure to 1/100 actual value. Measures line pressures to 10,000 psi with 0-100 psi gage. Line seals if bourdon tube ruptures. Isolates gage from line media and has shock-dampener and snubber.

Construction: Brass body and plated piston. Made for three dial ranges with 2½, 3½, or 4½-inch face.

Econ-O-Cage Co.
Sparta, N. J.
Circle **302** on Time-Saver Card

AIR-OIL BOOSTERS
. . . have built-in air filters

Features: Mount vertically to prevent weight of internal parts distorting seals. Porous bronze air filter threads into breather hole in air chamber. Air and hydraulic chambers made of honed steel tubing and connected with hardened steel tie-rods. Low price.

Wilton Tool Mfg. Co.
Schiller Park, Ill.
Circle **303** on Time-Saver Card

CONTROL VALVES
. . . with increased capacity

Designation: Model WP
Features: Fully balanced, self-centering, hardened and plated valve spools. Built-in cartridge type adjustable relief valve with hardened seat. Optional handle position. Each spool has separate ball check.

Specifications: Made with one and two spools for mobile equipment. Rated at 40 gpm and 1500 psi. Open-center, with 1-inch inlet and 1¼-inch outlet.

Cresen Mfg. Co.
Minneapolis, Minn.
Circle **304** on Time-Saver Card

CONTROL VALVE
. . . is diaphragm-operated

Features: Made in 3-way or reverse-acting. One-piece hardened stainless steel stem with integral seats that can't loosen in service. Leak-free replaceable hardened seat rings. Made with bronze or iron bodies and stainless steel trim.
Specifications: Diaphragm actuated by 25 to 35 psi air pressure. Can also be operated manually or by an electro-pneumatic cycle control. Ports ½ or ¾-in. NPT.

Sinclair-Collins Valve Co.
Akron, Ohio
Circle **305** on Time-Saver Card
Continued on page 58

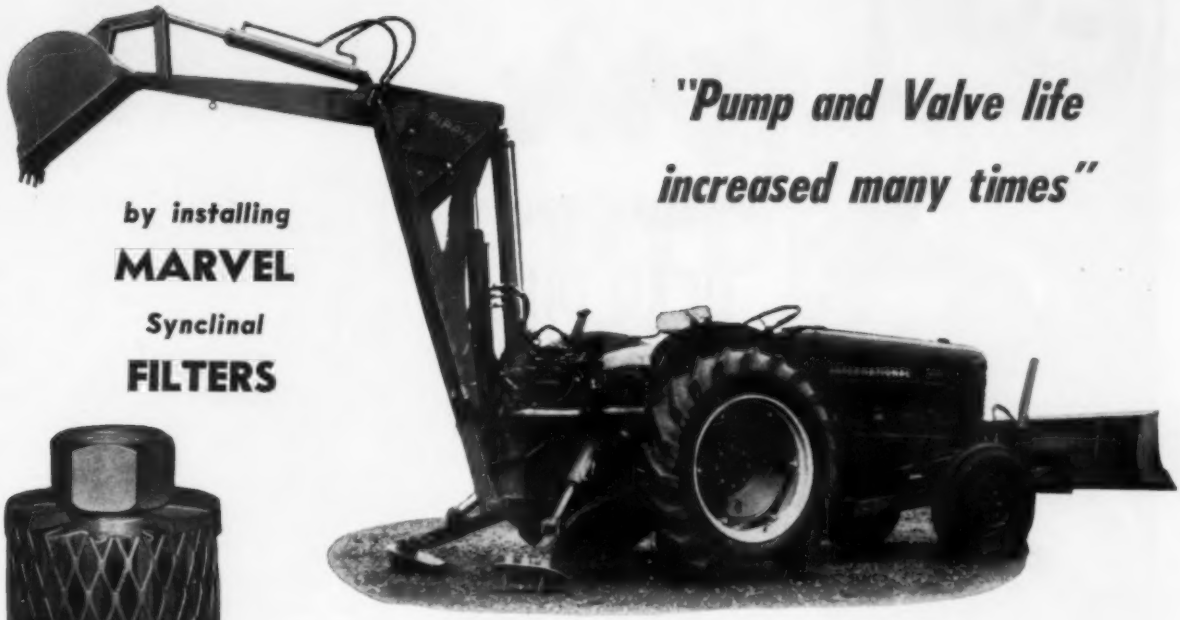
"Pump and Valve life increased many times"

by installing

MARVEL

Synclinal

FILTERS



PIPPIN Excavator and PIPPIN Angling Bulldozer

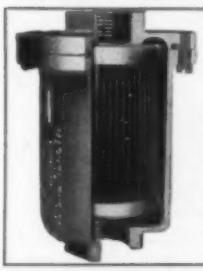
Pippin Construction Equipment, Inc. (Manufacturers) White River Junction, Vt. advise that—
"Originally the PIPPIN Excavator was not equipped with a filter. Due to this, excessive pump, valve and cylinder wear was experienced. Since installing the Marval Synclinal Filter, pump and valve life has been increased many times. Of utmost importance is the fact that customers are better satisfied and maintenance has been reduced to a minimum."

SUMP TYPE (Cutaway)

OVER 800 other Original Equipment Manufacturers are installing MARVEL SYNCLINAL FILTERS as Standard Equipment!

For Dependable Protection on Your Hydraulic and other Low Pressure Systems— investigate MARVEL SYNCLINAL FILTERS

Balanced, Synclinal design is the answer to the growing preference for Marval Filters to assure maximum protection of equipment—and maintaining the greatest degree of cleanliness of hydraulic oils, fire-resistant hydraulic fluids, coolants, lubricants and water.



IN-LINE FILTER

Handles up to 25 G.P.M. of hydraulic oil at very low pressure drop. Monel wire cloth filtering media is available in mesh sizes from 30 to 200. Cartridge is easily removed for cleaning.

EASY TO CLEAN

Both sump and line types may be easily disassembled, cleaned and reassembled by any workman, on the spot, in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation as described in catalog. Choice of Monel mesh sizes range from coarse 30 to fine 200.

IMMEDIATE DELIVERY

Our catalogs contain complete engineering data and dimensional charts of all models and sizes. You can order a filter to meet your specific requirements and get IMMEDIATE DELIVERY.

LINE TYPE (Cutaway)

For further information, write, wire, phone or use coupon below.

MEET J. I. C. STANDARDS

MARVEL ENGINEERING COMPANY

7227 N. HAMLIN AVE., CHICAGO 45, ILLINOIS
Phone: JUNIPER 8-6023

Without obligation, please send me complete data on Marval Synclinal Filters, as indicated: (AH-3)

- ☐ Catalog #108—For Hydraulic Oils, Coolants, Lubricants.
- ☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
- ☐ Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic)
- ☐ Catalog #301—For Water

Name ..... Title .....

Company .....

Address .....

City ..... State .....

BUILD ON...

Eastern

HYDRAULIC EXPERIENCE:

GEAR PUMPS and FLUID MOTORS

129 hydraulic pump and electric motor combinations are available off-the-shelf, for most applications. Outside this broad range, specific customer requirements can be met by drawing on Eastern's vast design resources.

All standard Eastern gear pumps are low in cost, light in weight, compact and reliable. Unique design features and very close tolerances enable each unit to achieve high volumetric efficiencies.

Check the performance ranges in these three major groups – do they meet your needs?

1200 series – up to 1.6 G.P.M. – pressures to 800 P.S.I.

100 series – up to 5 G.P.M. – pressures to 1500 P.S.I.

700 series – up to 9.8 G.P.M. – pressures to 1500 P.S.I.

In addition to these pumps, Eastern also produces a wide range of fluid motors, each capable of delivering a constant torque over a very wide speed range. They provide up to 14.5 ft. lbs. of torque at 1750 R.P.M. For full information on any one of these pumps, pump-and-motor combinations, or fluid motors, consult the Eastern sales engineer – or write for bulletin 810-N.

Eastern designs and builds

positive displacement pumps • gear pumps • centrifugal pumps

EASTERN INDUSTRIES INCORPORATED

100 SKIFF STREET
HAMDEN 14, CONN.

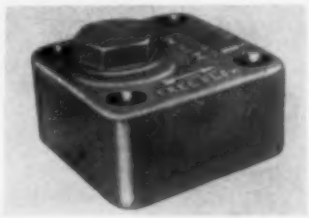
EASTERN INDUSTRIES PUMP DIVISION

Circle **46** on Time-Saver Card

NEW PRODUCTS

CHECK VALVES . . . meet JIC standards

Features: Made in subplate-mounted and sandwich type. Check is spring-loaded and can be mounted in any position. Reverse cracking pressure 10 psi. Made in



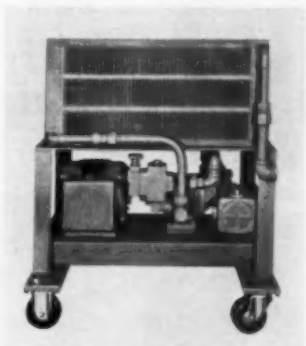
¾ and 1¼-in NPT. Sandwich type can be added to a circuit without breaking pipe connections. It fits between any Denison subplate-mounted sequence valve and the subplate itself. The ¾-inch has a capacity of 20 gpm and the 1¼-inch 65 gpm.

Denison Engineering Div.
American Brake Shoe Co.
Columbus, Ohio

Circle **308** on Time-Saver Card

HYDRAULIC FILTERING SYSTEM . . . is portable

Features: Cleans reservoir without interrupting operation. Flexible hoses draw oil through the filter. Clean oil returns to the reservoir



through a cooler. Mounted on the wheeled cart are, a 20-gpm pump, 110 v motor, relief valve, air to oil cooler, and a 50-gpm dirt-indicating filter. Unit contains an easily cleaned, removable filter cartridge.

The Rosaen Co.
Hazel Park, Mich.

Circle **307** on Time-Saver Card

Continued on page 60

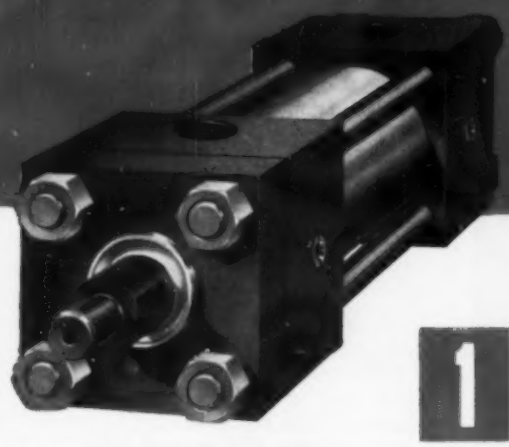
Circle **98** ➡

SEAL FAILURE MEANS CYLINDER FAILURE

Petroleum base, fire-resistant and special hydraulic fluids cause distortion and rapid deterioration of the seals currently used in many hydraulic cylinders, resulting in costly repairs and cylinder failure. (Seals made of synthetic rubber are not compatible with even 50% of available commercial petroleum base fluids and the life of such seals is materially reduced at operating temperatures above 150° F.)

Specify Miller HYDRAULIC CYLINDERS

FOR UNLIMITED SEAL LIFE!



Request Bulletin JH-104N for complete data plus helpful charts on column strength, cylinder forces, factors of safety, acceleration, pipe pressure losses, etc.

1 ALL TEFLON* SEALED Against External Leakage

TEFLON is impervious to all known hydraulic fluids, including all fire-resistant and special types—and withstands temperatures from —100°F. to plus 450°F.

TEFLON SHEF SEAL AT TUBING ENDS

No blind assembly. Is
Shear-proof
Heat-proof
Extrusion-proof
Fluid-proof

TEFLON SEALS ON PISTON ROD AND BUSHING

Teflon rod flange seal requires no adjustment. Teflon bushing seal is shearproof. Teflon wiper keeps dirt out.

TEFLON SEALS ON BALL CHECK AND ADJUSTING SCREW

Non-protruding, self-locking, cushion adjusting screw interchangeable with ball check for easy access.

2 CASE-HARDENED CHROME PLATED PISTON RODS

Provide foolproof protection against seal failures resulting from rod damage. The Miller case-hardened rods (50-54 Rockwell C) give practically complete immunity to damage from hammer blows, wrench-dropping, mishandling, etc. The hard chrome plating over the case-hardened rods protects against scratch-damage and rust.

AVAILABLE IN TWO TOP QUALITY LINES

JOB-RATED
Model "J"

PRICE SAVINGS OF 27% OR MORE!

19 mounting styles, all strokes, cushioned and non-cushioned. Large selection for immediate shipment.

BORE	SEVERE OPERATING CONDITIONS	MODERATE OPERATING CONDITIONS	YOU SAVE THIS % IN PRICE OVER STANDARD 2000-3000 PSI CYLINDERS
1½"	1500 PSI	2500 PSI	27%
2	1500	2500	27%
2½	1000	1500	28%
3¼	1500	2500	32%
4	1000	1500	35%
5	800	1200	37%
6	800	1200	43%
8	500	800	50%
10	500	800	71%
12	500	800	76%
14	500	800	*Not Available in 2000-3000 PSI*

POWER-PACKED
Model "H"

50% More Power Per Cylinder Dollar!

For
3,000-5,000 P.S.I.

1½" through 12" bores, 17 mounting styles, strokes up to 22 ft., cushioned and non-cushioned. Large selection for immediate delivery.

*DuPont trademark for its tetrafluoroethyline resin

OTHER MILLER QUALITY FEATURES

- Solid Steel Heads, Caps and Mountings.
- Precision-Honed Barrels.
- Rust-Resistant Coating on All Non-Wearing Surfaces.
- Space-Saving "Square" Design.

MILLER FLUID POWER
DIVISION OF FLICK-REEDY CORPORATION

2008 N. Hawthorne Ave., Melrose Park, Illinois

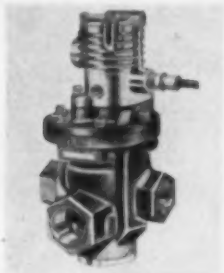
AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

NEW PRODUCTS

POPPET CONTROL VALVE
. . . is pilot operated

Features: Fast response. Only two moving parts. Poppet is air cushioned. Bronze body, stainless steel internal parts, and Hydar seals. Pilot operation is separate from the line pressure the valve is controlling.

Specifications: Made in 2 and 3-way, normally-open and normally-closed. Size ¼ to 1½-inch NPT.



Working pressures 1-inch Hg vacuum to 20 psi. Solenoid coils for any voltage ac or dc and guaranteed against burnout for the life of the valve.

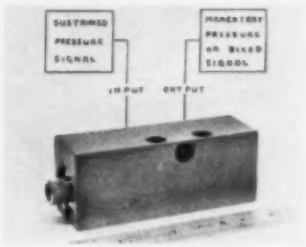
Valvair Corp.
Akron, Ohio

Circle **308** on Time-Saver Card

MOMENTARY CONVERTER
. . . for air valves

Designation: V125A

Features: Gives adjustable short duration pressure or bleed output signal from a sustained pressure input signal. Operates with any balanced 3 or 4-way air valve. Duration of output signal is adjustable



from 0 to 10 sec with 80 psi air. Cycles to 100 per min.

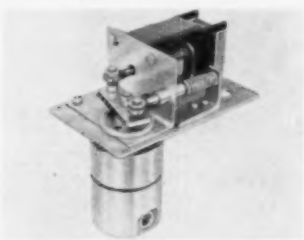
Specifications: Housing and spool are aluminum and seals are O-rings. Ports are ⅛ inch NPT.

Hause Machines, Inc.
Montpelier, Ohio

Circle **309** on Time-Saver Card

SOLENOID VALVES
. . . for 10,000 psi

Features: "Shear-Seal" design with optically flat metal to metal sealing surfaces. Flow is through the center and not across sealing surface.



Seals lap themselves with each valve operation.

Specifications: Made in shut off and 4-way, in ¼, ⅜, and ½-inch port sizes. Operating pressure 10,000 psi with surges to 15,000 psi. Burst pressure 30,000 psi. Solenoids for 115, 230, and 460 volt ac.

Barksdale Valves
Los Angeles, Calif.

Circle **310** on Time-Saver Card

For more NEW PRODUCT reviews turn to page 131

BHEW
Hydraulic Cylinders

- Basic Designs
- Specific Adaptations
- Superior Quality
- Application Engineering

THIS IS BHEW'S 1500 PSI SERIES DOUBLE-ACTING GENERAL-PURPOSE CYLINDER, designed around standard components, but custom-built to suit *your* application. Available in a variety of mountings, with or without adjustable or non-adjustable rod ends.

• Self-adjusting "V" packed rod glands • "U" cup seal on pistons • Honed steel barrel • High-tensile, hard chrome plated rods • Packings for extreme high and low temperatures, most non-flammable fluids.

Production parts save you money, do the job better! BHEW basic cylinders can easily be modified to fit your *specific* product applications. You benefit from production economies; you get custom-built cylinders.

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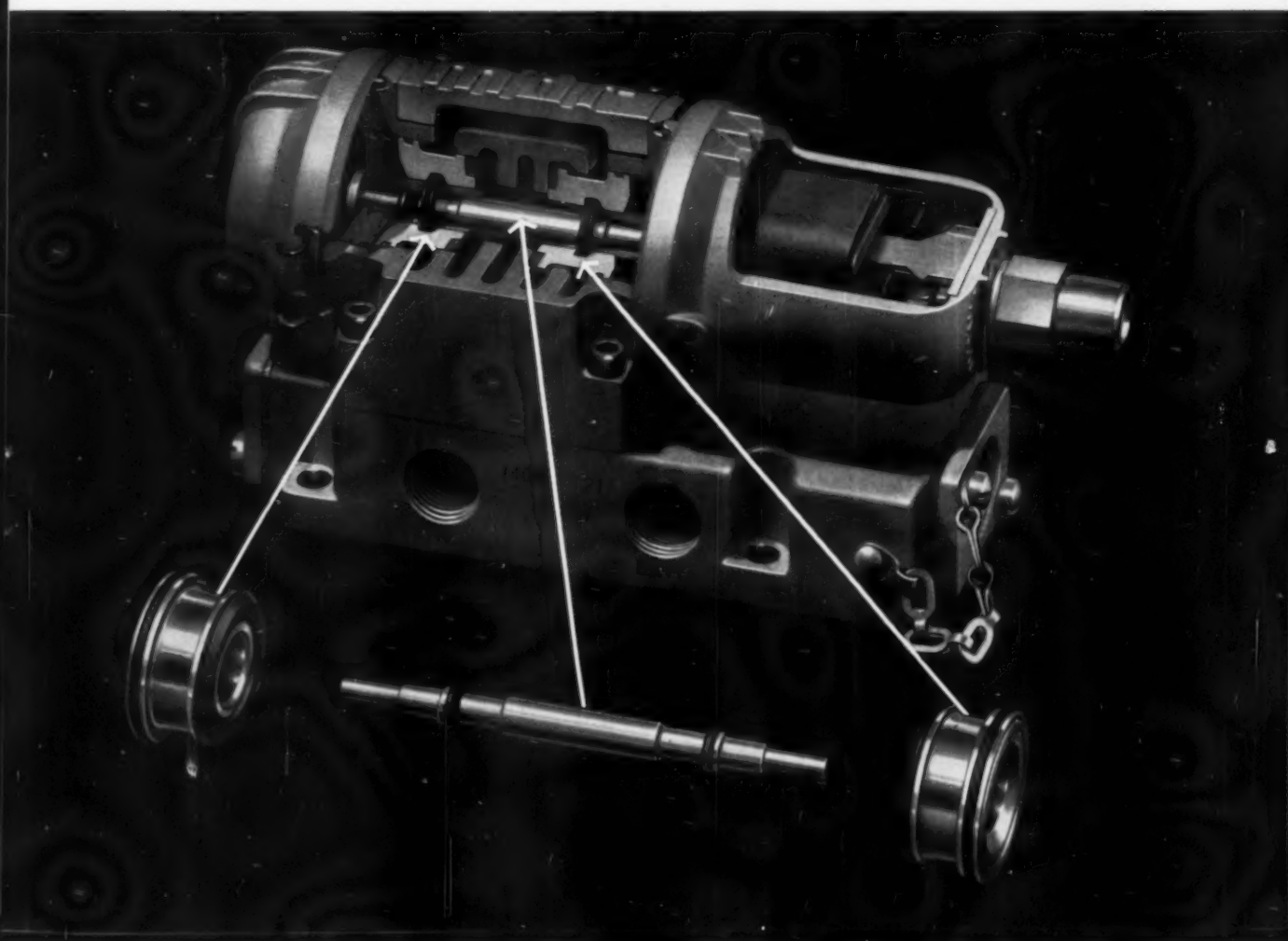

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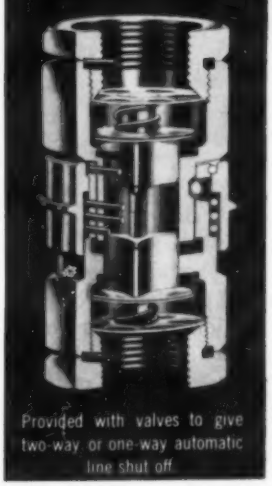

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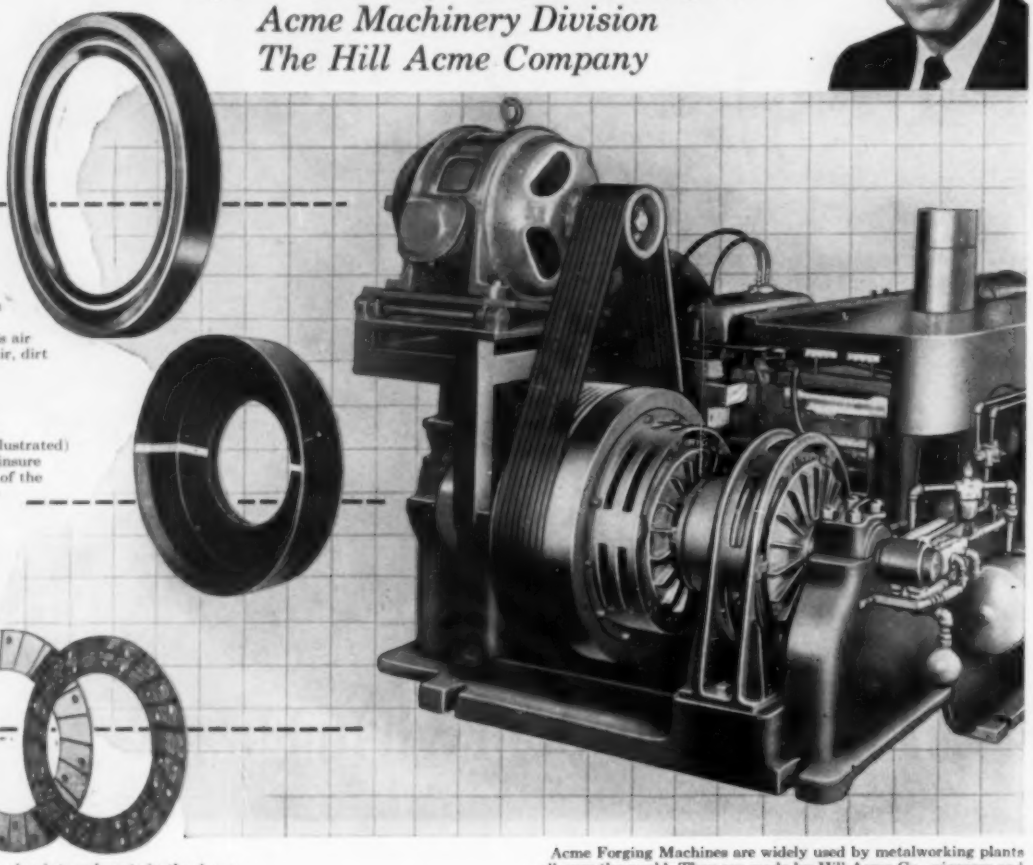

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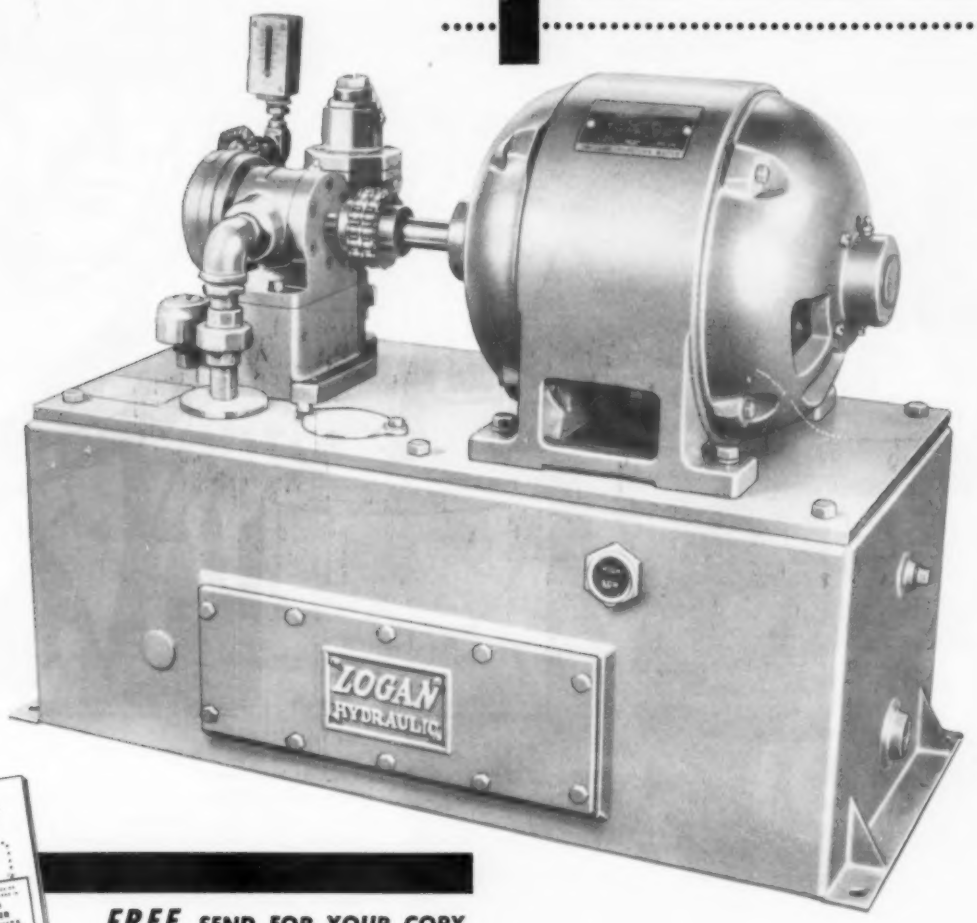

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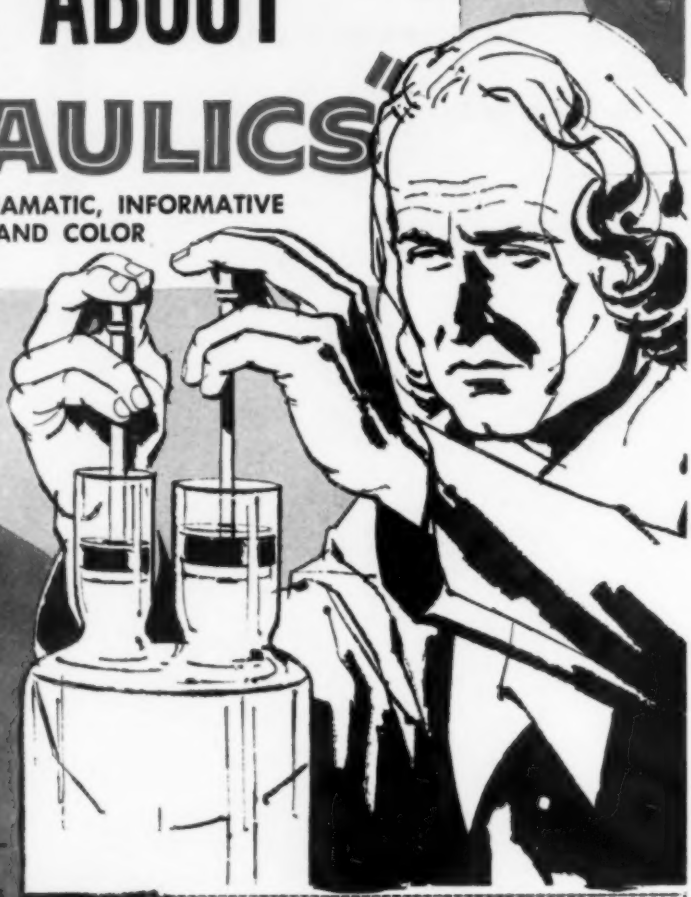

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APPLIED Hydraulics & Pneumatics
MARCH, 1959

New hydrostatic drive uses variable displacement piston motor

• By WALTER SHAFFER, *Staff Research Engineer, Towmotor Corp., Cleveland, Ohio*

These are the details about a hydraulic system that was changed completely by the development of a pressure-compensated, variable-displacement motor. The new system was introduced late in 1958.

SINGLE pedal, fine control for start, stop, reverse, and creep has been the attractive advantage offered by a hydrostatic drive. This has led designers to work for a practical system.

Cost is the big barrier. The job is not just to build a drive that has enough torque and good speed control. The drive must have enough advantages so that it can compete with a mechanical transmission or hydrokinetic drive.

At the present level of production, the hydrostatic drive developed by Towmotor Corp. costs appreciably more than a torque-converter drive. This drive, however, eliminates clutches and this plus operating advantages and reduced maintenance offset the extra cost.

• **Motor Characteristics** — Each drive wheel is driven by an independently mounted, axial-piston motor. Output characteristics of the two motors are based on these fundamental equations:

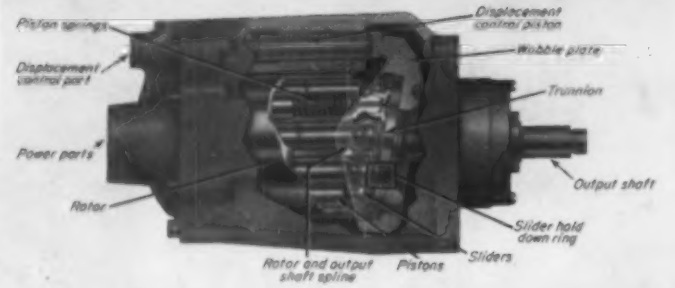


FIG. 1. COMPACT, axial piston, 2000-psi, motor is varied by oil pressure on control piston. Wobble plate angle changes when pressure exceeds 1600 psi.

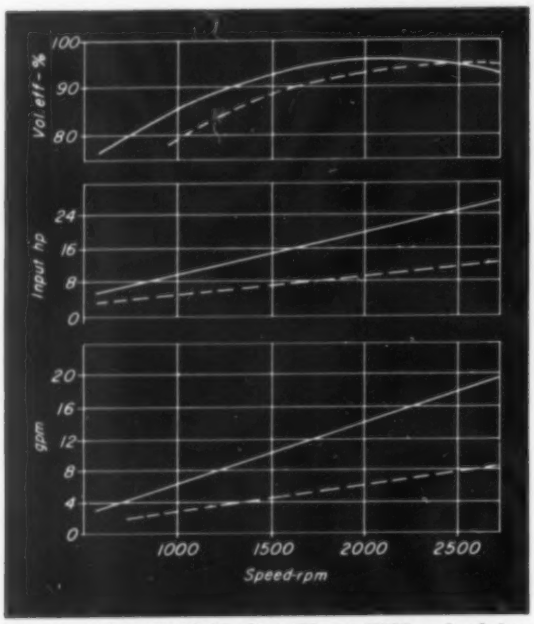


FIG. 2. PERFORMANCE CURVES at 2000 psi of two gear pumps used on this drive. The small pump powers motors during creep.

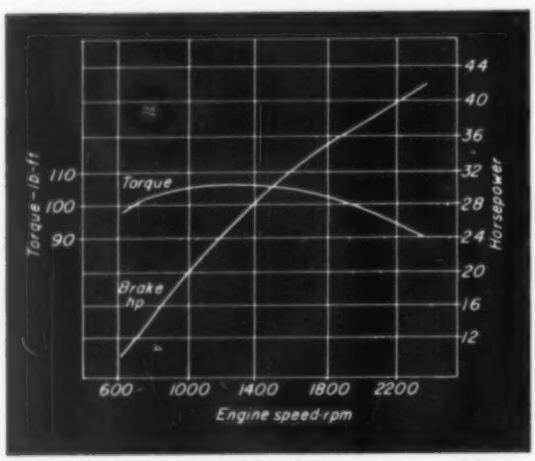


FIG. 3. ENGINE PERFORMANCE shows torque and horsepower available to drive the pumps.

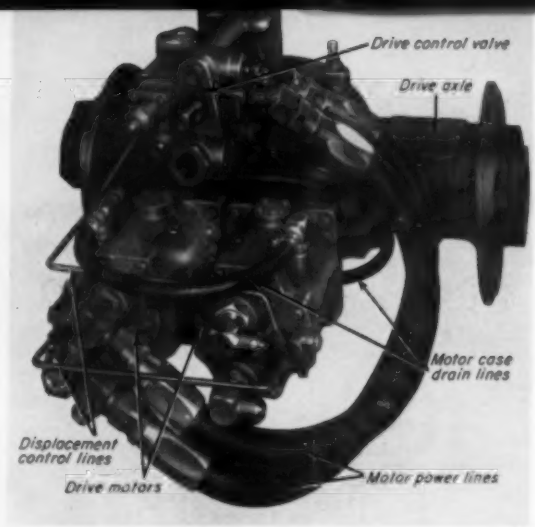


FIG. 4. DRIVE PACKAGE includes motors and control valve mounted on the drive axle. Complete assembly is compact and accessible.

FIG. 5. CIRCUIT shows oil flow pattern through all components when valves are in neutral.

$$T = \frac{pd}{2\pi} \quad \text{..... 1}$$

where T = torque, lb.-in.
p = pressure, psi
d = displacement, in^3/rev

$$N = \frac{Q}{d} \quad \text{..... 2}$$

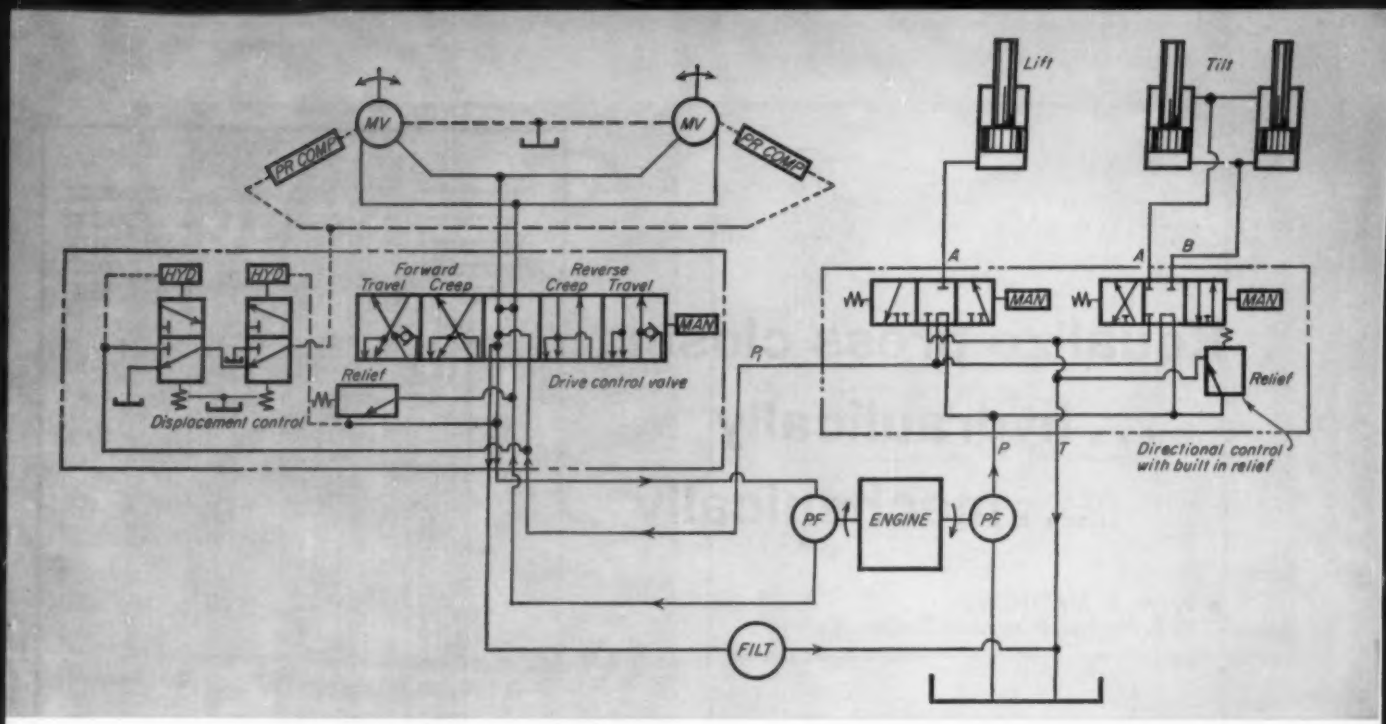
where N = speed, rpm
Q = oil delivered, in^3/min
d = displacement, in^3/rev

The motors are designed to operate at minimum displacement, 1.25 in^3/rev at all system pressures up to 1600 psi. This provides enough torque for creeping, maneuvering and traveling. At 1600 psi, the displacement control operates. Motor displacement reaches a maximum of 3.2 in^3/rev above 1600 psi. Maximum displacement, and the resulting maximum torque, is reached when the truck climbs a grade. Maximum system pressure is limited to 2000 psi.

Use of the variable displacement motors improves system efficiency because the motors go into low displacement for traveling and require a small volume of oil at an efficient operating pressure. A fixed displacement motor would have to be sized big enough to meet the highest torque requirement, needed only at peak loads. A large volume of oil at low pressure would be required for traveling.

Displacement of the motor is varied by pressure acting on a control piston which changes the angle of the wobble plate (Figure 1). This action is completely automatic in response to the load.

• **Pump Selection**—The drive has two gear pumps rated at 2,000 psi continuous working pressure. Their performance is shown in Figure 2. The high-volume (13 gpm at 2000 psi, 1800 rpm) pump supplies most of the oil for the drive motors during full speed travel, and all the oil for the lift, tilt, and any accessory



operations. The lift and tilt cylinders have priority for the volume from this pump.

A low-volume (5.4 gpm at 2000 psi, 1800 rpm) pump supplies oil to the drive motors during creeping. This volume is added to oil from the large pump during full-speed travel. Since only the low-volume pump is used for inching, there is little waste of engine power. The engine delivers only the torque required to drive the small pump. Selection of the pumps is based on the torque characteristics of the internal combustion engine (Figure 3).

• **Valve Design**—A conventional, 2-spool valve with built-in relief controls direction and speed of the tilt and lift cylinders. The only modification is porting to allow flow of the large volume pump to go to the drive control when the lift and tilt spools are in neutral.

Drive control is from a foot pedal. Toe pressure gives forward travel; heel pressure gives reverse travel. Creeping and braking is controlled by positioning the foot pedal to either side of neutral. In neutral, all motor and pressure ports are open to tank. A conventional parking brake is used to hold the truck when parked.

The drive control valve and motors are mounted on the drive axle. Porting is arranged so that during creeping the volume from the large pump goes to tank. During travel in either direction, volume from both pumps goes to the motors. The valve has a built-in relief, and the displacement control valve is also integral with the drive control valve.

• **Displacement Control**—Actuation of the motor displacement control piston depends on the pressure from the large volume pump. With the drive control valve in neutral or creep positions, this pump is unloaded. Therefore, there is no pressure on the displacement control and the motor pistons are at minimum stroke. When the control valve is in travel position, a load increase resulting in pressure buildup beyond 1,600 psi causes the displacement control valve to shift. Pressure then actuates the displacement control piston increasing displacement to give increased torque.

The displacement control includes a limiting valve which keeps the motors from going into maximum displacement if the control pedal is suddenly reversed while the truck is traveling at high speed. Momentarily, at the cross-over, the motors act as pumps; pressure increases to open the relief valve to a flow which is greater than the total from both pumps. Because of this increased flow through an orifice beyond the relief, pressure at the outlet of the relief valve increases to approximately 35 psi. This pressure acts on the relief flow sensing valve to keep high pressure off the displacement control piston and prevent a change to maximum stroke. This permits the motors to act as pumps at minimum displacement only.

Approximately 8 gallons of oil are in the system. A pleated paper filter in the return line from the drive control valve gives 25 to 40-micron filtration.

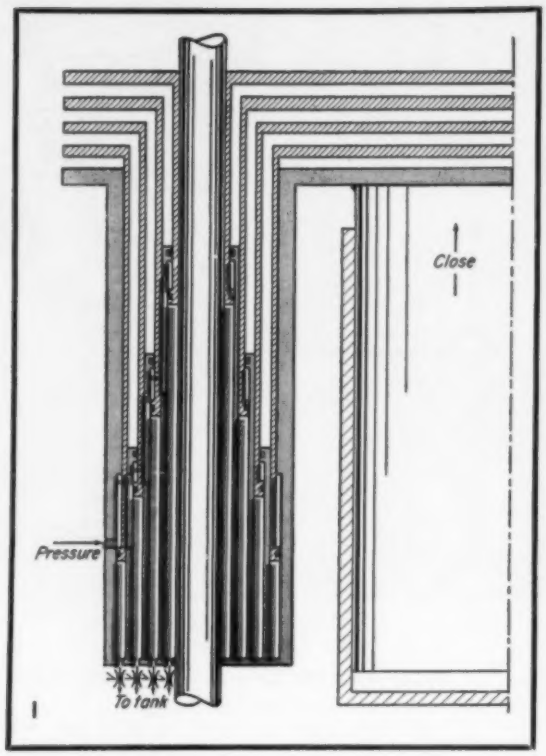
The use of two pumps and the variable displacement motors gives a hydraulic circuit which does not require a heat exchanger. This is a measure of the efficiency of this system.

Economies resulting from increased production of this drive open a new era in industrial truck application and design. □□□

EDITOR'S NOTE: AH&P published an article by Mr. Shaffer in December, 1956. In it he described Towmotor's experimental model of a hydrostatically-driven truck. Three fixed-displacement pumps powered a fixed-displacement motor. Valving used to unload unneeded pumps gave a characteristic approaching a variable delivery pump.

Equalize press closing ... hydraulically ... mechanically

• By W. R. MATTHEWS
W. R. Matthews & Associates, Spokane, Wash.



Two systems—one hydraulic and the other mechanical—make press platens move together and close at the same time instead of in sequence. This gives equal compression on each work piece and permits a shorter cycle time.

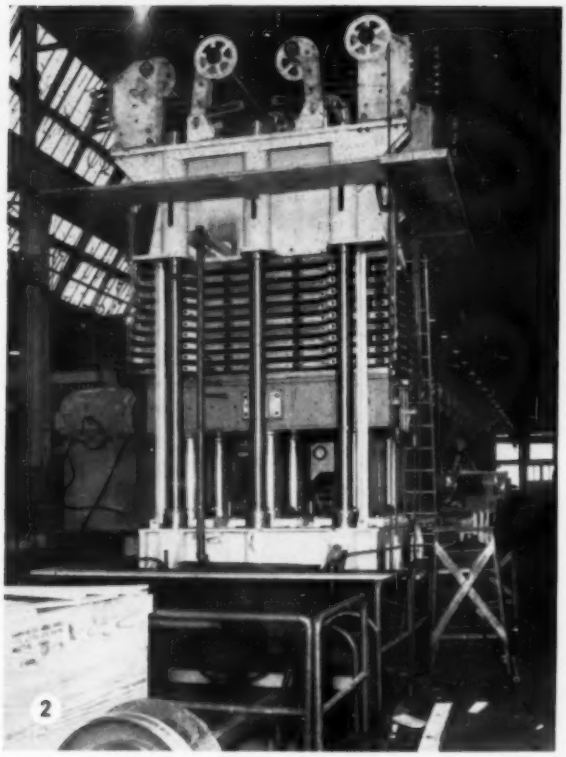
IN CONVENTIONAL platen presses, the platens close in succession as the ram rises picking up the platens. This causes an unequal loading on the work, and also limits the speed of opening and closing to prevent the powdery material being processed from blowing out.

Both hardboard and particle board which are made on these presses are made from a light, fluffy mass called a *mat*. This mat is a mixture of wood fiber or particles with a thermosetting-resin, adhesive binder. In a conventional press, the lowest mat is compressed first, then the second, and so on to the top mat in the press. The weight of each platen adds to the compression of the mats below, so compression of each mat is not equal. Furthermore, the time of compression is longer for the bottom mats than for the upper ones.

In a typical 10-opening press with 5 in. of daylight between platens, the ram stroke is 10 x 5 in. or 50 in. With a ram speed of 50 in./min, closing time is one minute. Each platen closes at the same rate as the ram and requires 6 seconds to close and 6 seconds to open. Since the platens close in sequence, the heating time on each mat ranges from 12 sec on the top one to 120 sec on the bottom one.

The platens for a typical press weigh about 4500 lb each. This is 1 lb/sq. in. for a press with platens 90 x 50 in., so the pressure on each mat ranges from 1 psi to 10 psi in addition to the ram force. This difference in pressure causes unequal heating. With the latest developments in adhesives, the cycle time is not only short, but the total time under pressure must be limited. Thus with a short heating cycle of three minutes, the variation in heating time is considerable. A 20 or 30-opening press has an even greater variation than the 10-opening unit.

• **Hydraulic Equalizing**—A hydraulic system replaces the conventional notched bars, which space the open platens, with four telescoping equalizing cylinders. Each cylinder has concentric pistons attached to each platen. The cylinder rod is fixed to the press bed, and the body is fixed to the lower platen and raised by the main ram as the up-acting ram closes the press. As the cylinder rises, its pistons raise the press platens. However, fluid is metered equally from each concentric section of the cylinder, so that the pistons move down with respect to the cylinder. Because of the difference in areas of the pistons, each piston moves *down* faster than the next larger one. Another way of visualizing this is that



each piston moves *up* slower than the next larger one. The effect is that each platen moves up slower than the next lower one, and all press openings close at the same time.

The system can be applied to presses already built, or to new presses. Opening and closing speeds of 500 in./min. or more can be obtained. A 10-opening press has 1/10 the cycle time of one without the equalizing system.

• **Mechanical Equalizing**—In the mechanical equalizing system developed by Washington Iron Works of Seattle, each platen is lifted by cables. A cable from each corner of the platen runs over a fixed pulley, then over a pulley mounted on a rotating arm, and is anchored. As the ram rises, it pulls its corresponding rotating arm toward the center. This in turn pulls all the moving pulleys and raises the platens. The movement of each pulley proportions the distance and speed of its corresponding platen.

The cables are anchored by springs to allow for differences in the mat thickness between platens. The main cable is also attached to the main ram by a spring to allow for considerable variation in loading the press.

Several of these presses are in operation and are giving satisfactory results. One is making a hardboard of fine wood fiber, using a dry, powdered adhesive resin. Another makes both plywood and doors, which are considerably different in thickness. □□□

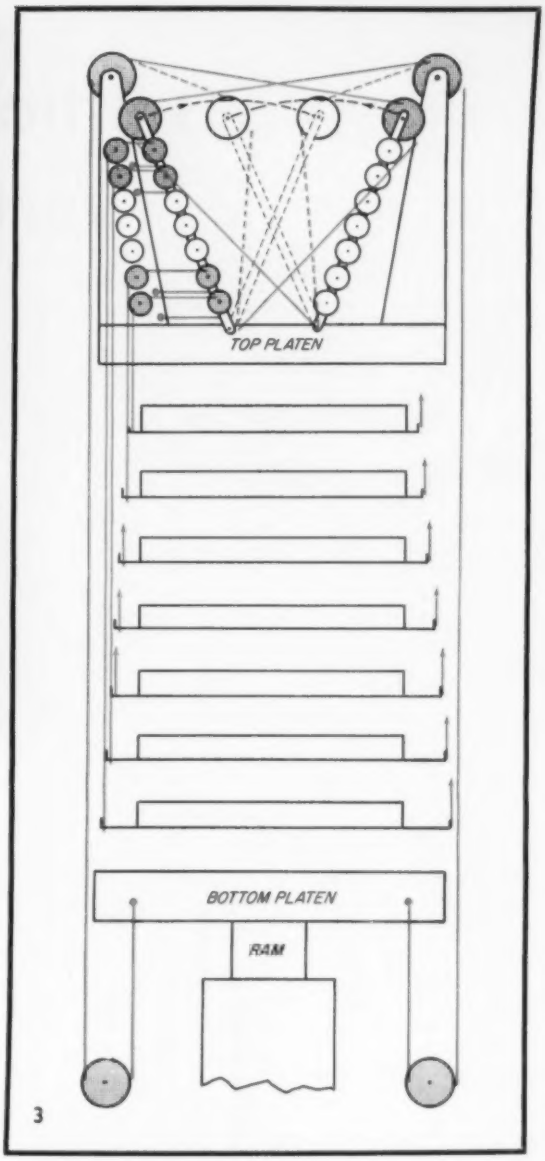
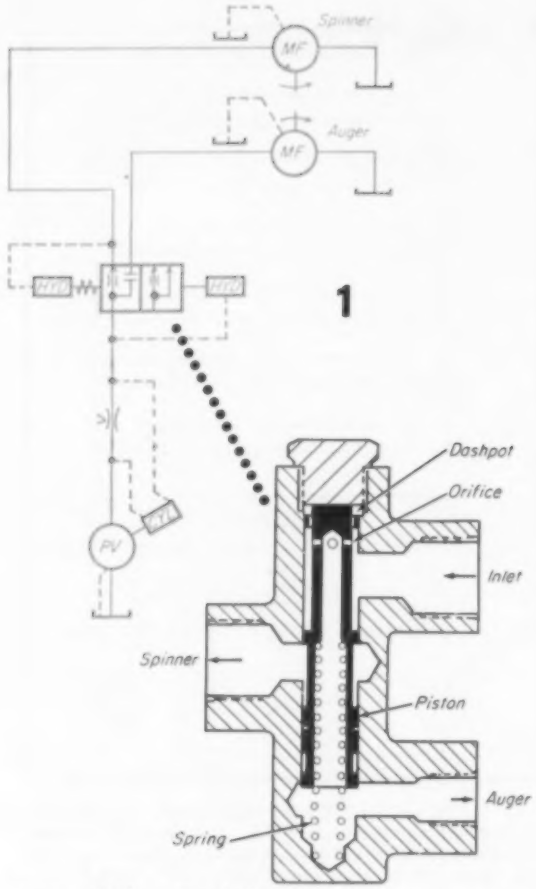


FIG. 1. ON HYDRAULICALLY EQUALIZED PRESS, fluid is metered equally from lower cylinder ports allowing concentric pistons to move down with respect to cylinder. Inner piston raises upper platen, outer piston raises platen next to bottom. Piston areas give correct platen speeds for simultaneous closing.

FIG. 2. UP-ACTING HARDBOARD PRESS with mechanical equalizing uses lifting cables attached to each corner of platens. Anchoring the cables with springs allows for different thickness of work between platens.

FIG. 3. CABLES ATTACHED TO EACH CORNER of platens raise them together. Upward movement of main ram draws hinged arms at top to center of press. Pulleys on hinged arms move in as press is closed, so speed of each platen is faster than one above it.

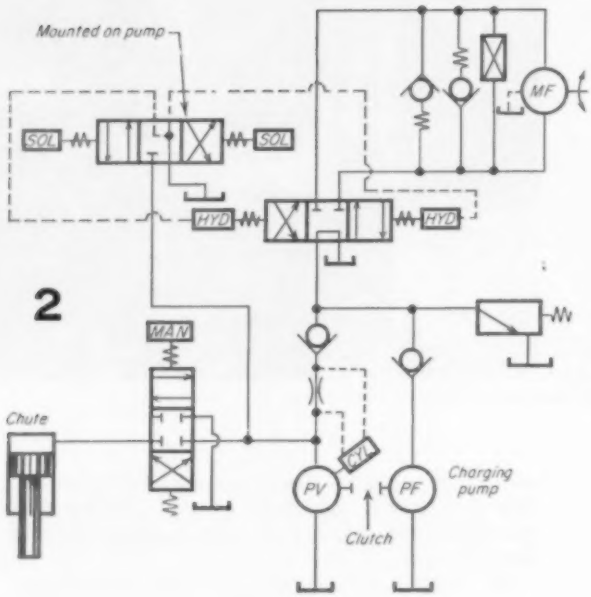
3 efficient speed control variable displacement



Courtesy Webster Electric Co.

1 **PARALLEL SPREADER DRIVE**—On a salt spreader, an auger feeds salt from the truck, to a spinner which throws it out on the highway. Speeds of the auger and spinner must be independently variable, so the driving motors are connected in parallel. A priority type flow divider directs a fixed flow to the spinner. Remaining flow is directed to the auger. Spinner speed is regulated by an orifice in the flow divider.

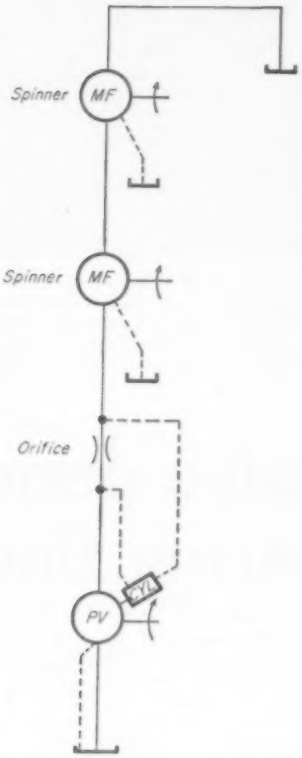
Fixed, priority flow to auger motor is maintained by balance of pressure forces and spring force on piston. Auger pressure force plus spring force equals inlet pressure force. Thus pressure drop across orifice and flow through it are constant. Flow in excess of auger requirement raises inlet pressure to push down plunger and then flows to spinner. Auger speed is regulated by the flow control valve at the pump.



2 **MIXER DRIVE**—A cement mixer must be driven at constant speed. This circuit holds drum speeds within 5%. Pressure drop across the flow control valve is applied to a piston in the pump to regulate displacement. A solenoid-controlled, pilot-operated, 4-way valve controls direction of fluid motor drive. Relief valves brake the motor when the directional valve is centered.

The constant displacement charging pump supplies added fluid to boost speed about three times during the one to three minutes while the drum is charged with cement and gravel. It is then declutched from the shaft of the variable volume pump. Charging pressure is 800 to 1200 psi, normal operating pressure is 500 to 550 psi. Normal speed of the main pump is 2000 rpm. During charging it runs at 3600 rpm.

circuits with pumps



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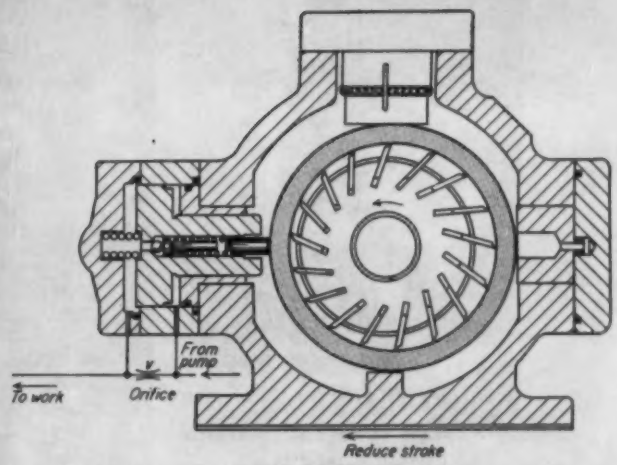


Courtesy Racine Hydraulics & Machinery, Inc.

VARIABLE VOLUME PUMP—Vane type pump maintains output constant at any setting of the variable orifice, with speeds ranging from 500 to 2500 rpm. Pressures on each side of the orifice are applied to a piston governor which controls pump displacement. Pressure at the orifice outlet is connected to the blank end of the control piston. Pressure at the inlet is connected to the rod end of the piston. Increased speed of the pump (because of engine drive) raises pressure at the orifice inlet. Unbalance of forces on the control piston strokes the pump to reduce displacement, maintaining constant flow at higher speed. A decrease in pump speed causes the pump to be stroked for increased displacement. The piston is stable when rod end force equals head end force, plus force of a light spring which returns the pump to maximum displacement.

The orifice is sized for a pressure drop of 40 to 50 psi. By venting the blank end of the control piston, pump pressure is reduced to 50 to 75 psi, which is just enough to overcome the light spring. Delivery is only that necessary to make up leakage and maintain this pressure. A relief valve built into the control piston protects against system over-pressure.

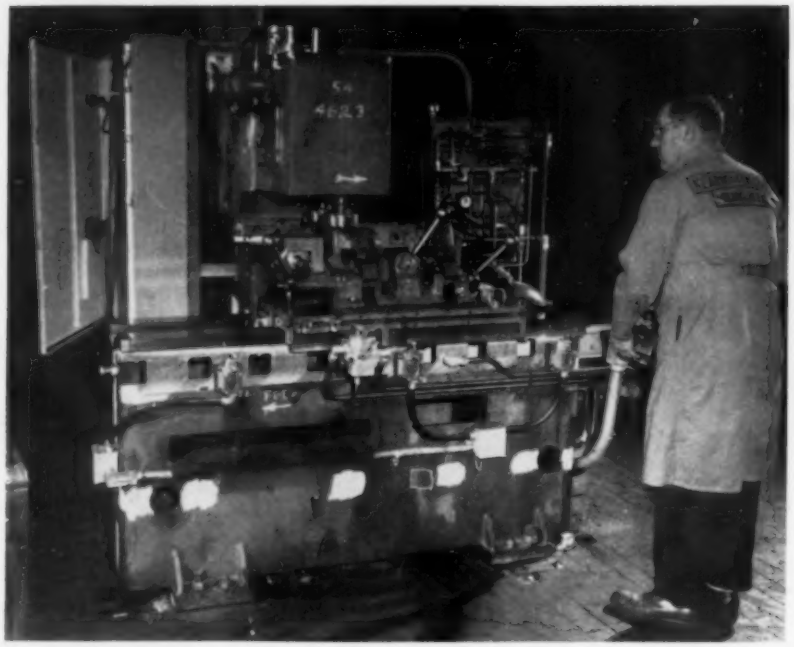
Mixers have usually been driven by gasoline engines, but these make bulky drives that require considerable maintenance. Hydraulic drive has cut down size and weight, and requires only a small part of the maintenance.

The reservoir is sized about 1:1 with pump output, without problems of overheating. The pump, flow control valve, directional valve, and relief valve are mounted together on a small base which is assembled before installation. This cuts down piping and makes a compact power unit.

3 **SERIES SPREADER DRIVE**—Flexible speed control is needed for a machine which spreads materials such as lime. Each material has to be spun out at a certain speed, so this easily controlled hydraulic system is better than mechanical methods which depend on the speed of the vehicle. Connecting the spreader motors in series simplifies the circuit, eliminates flow dividers. Speed of both spreaders is the same except for variations caused by motor slip. Operating pressure ranges from 500 to 900 psi depending on the material being spread. The high efficiency of the variable volume pump and flow control valve combination is especially important because of small reservoirs (about half the pump output per minute) on this type of equipment.

Cost is a big factor in selecting components for this type of equipment. Simplicity of the variable volume pump circuit makes it competitive with a system having a fixed volume pump. □□□

On special machines like this miller built by Kearney & Trecker, you can save time and material by mounting valves on modular subplates that bolt together to form a panel.



SPECIAL MACHINE for milling ridge on top of automotive cylinder head has cylinder-actuated tool slide and work table. At start of cycle, table rapid advances from right to center position. Tool slide then feeds forward to a positive stop, milling one end of ridge. Table feeds to left as cutters mill both sides of ridge. Tool slide returns, milling remaining edge, and table rapid returns to starting position.

Prefab valve panel saves engineering time

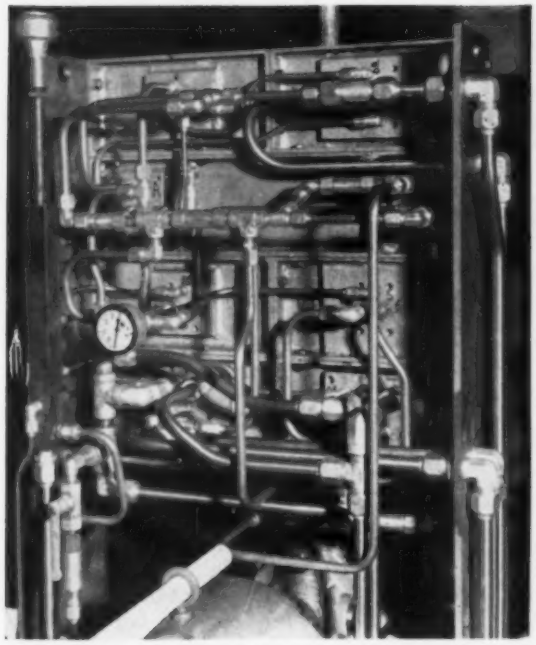
• By W. P. BARTZ, *Hydraulic Engineer, Special Machinery Div., Kearney & Trecker Corp., Milwaukee, Wis*

LAYOUT and fabrication of a valve panel can be a major part of the hydraulic design of a special machine. To eliminate the job of burning out holes in a solid panel, drilling and tapping mounting holes, and designing special panel mounting, Kearney & Trecker uses individual panel sections supplied with a ground surface and mounting holes for the specified valve. These sections are bolted together to form a valve panel which is mounted over the reservoir with two, $\frac{3}{8}$ x 8 in. steel legs which also serve as bulkheads for piping to the machine.

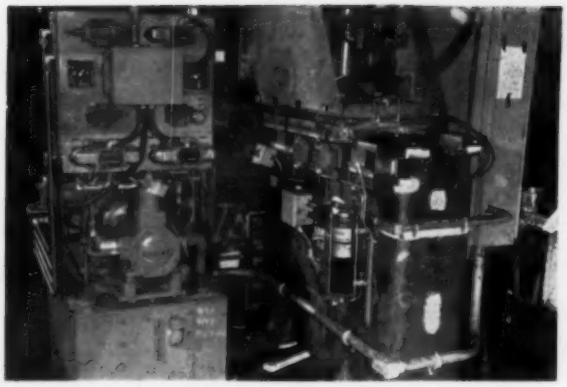
To determine what valve sections are needed, the valve panel is laid out in block form showing the individual panel sections. The position of the valves on the panel is determined from the circuit diagram according to the way the valves are connected together. Each panel section is then marked with the make and part number of the valve to be mounted on it, and the corresponding number of the panel section is added.

The bulkhead-legs have been standardized with different mounting feet to fit various reservoirs commonly used, and to accomodate the number of rows of panel sections from 1 to 4. Part numbers of the bulkheads have been arranged in a table, so they can be selected according to the make and size of the reservoir, and the number of valve section rows. Bulkheads have also been designed for machine mounting.

The panel drawing is usually put on the same sheet with the hydraulic circuit, but to save drawing time on larger jobs having more than three valve panels, a sheet with six panel outline drawings is used. This is filled in with specification information. □□□



REAR VIEW OF VALVE PANEL shows how sections are bolted together. Panel is mounted over reservoir; supports also serve as bulkheads for piping to machine. Drain manifold is vented to atmosphere through air filter cap. Ball type, 2-way valve (lower left) is in bleed-off, filter circuit.



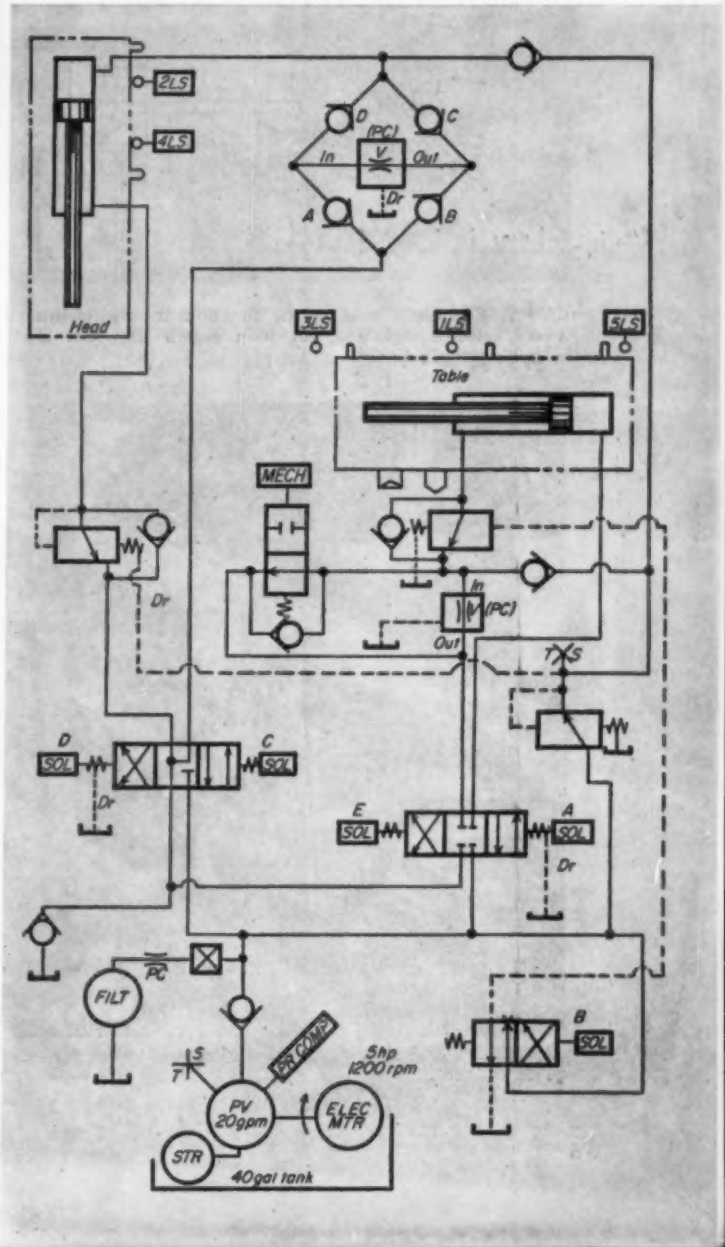
FRONT VIEW OF VALVE PANEL shows mounting of eight valves. Electrical junction box is located in center with connections to directional valves and motor. Pressure-compensated pump requires no relief valve.

TABLE CYLINDER, shown in circuit diagram, is stopped in mid-position by remotely controlled sequence valve. Solenoid **B** is actuated during rapid table travel. When deceleration valve is actuated by a cam on the table, it blocks free exhaust flow from the cylinder rod end and forces it through the flow control valve, slowing the table. When limit switch 1-LS is actuated, it deactuates solenoid **B** to stop table and energizes solenoid **C** to advance tools. Pressure on both sides of the table cylinder holds work rigid during machining.

Tool head speed is controlled by flow through check valves **A** and **C**, and flow control valve which meters flow into cylinder during extension and flow out during retraction. Tools feed against a positive stop, actuating limit switch 2LS which actuates solenoid **B** to start table feed again. When table trips limit switch 3-LS, it energizes solenoid **D** to retract tool cylinder. Exhaust flow is through check valves **D** and **B** and flow control valve.

When tool head trips limit switch 4-LS, solenoids **E** and **B** are energized for fast return of table. At end of stroke, limit switch 5-LS trips to de-energize solenoids **E** and **B** completing the cycle.

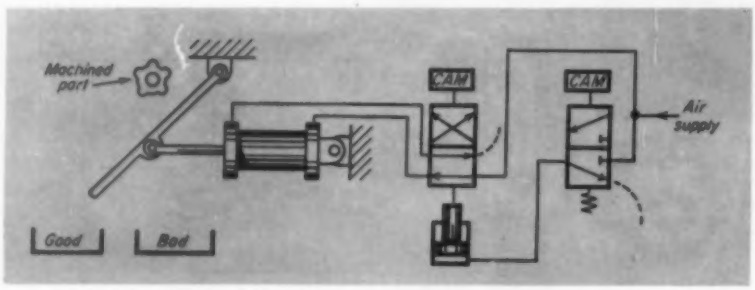
Pressure reducing valve applies low pressure oil to the compensating pistons of flow control valves to keep them actuated when 4-way valves are centered. This prevents jump when the 4-ways are actuated, directing first surge of oil through flow controls. If pressure reducing valve should fail to open, it would connect full pressure (deadhead setting of pressure-compensated pump) to spring section of counterbalance valve. This would prevent tool head from advancing.



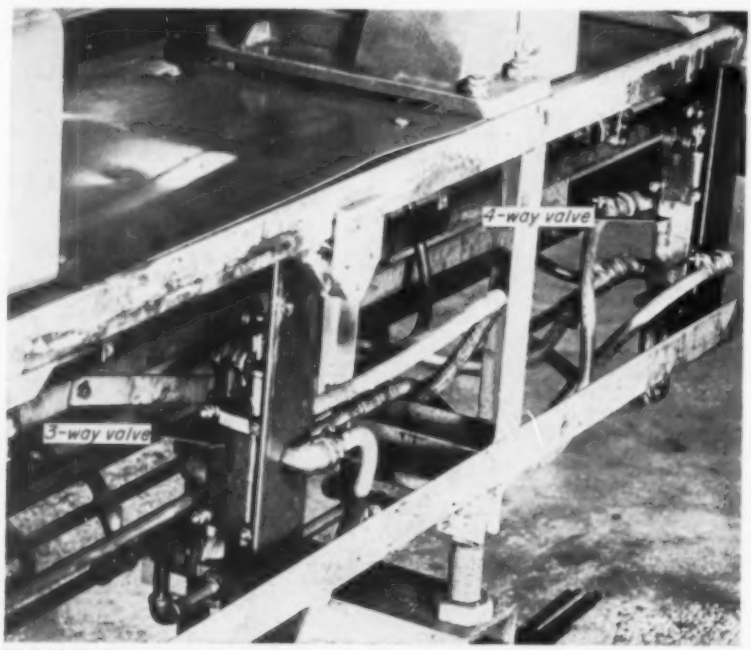
Air system reduces inspection

"Convert our automatic screw machine to reject the irregular pieces made from each end of a bar." That was the request of Wayne Griffith at P. R. Mallory & Co. in Indianapolis. Here's the air system that did it.

• By V. C. DIEFENDERFER
Westinghouse Air Brake Co., Industrial Products Division, Wilmerding, Pa.



CAM SHIFTS 4-way valve in one direction. It stays in this position until cam on 3-way valve is actuated. Air then enters the pilot and shifts 4-way valve extending the cylinder.



BAR-FEED TABLE showing position of control valves for extending and retracting guide cylinder.

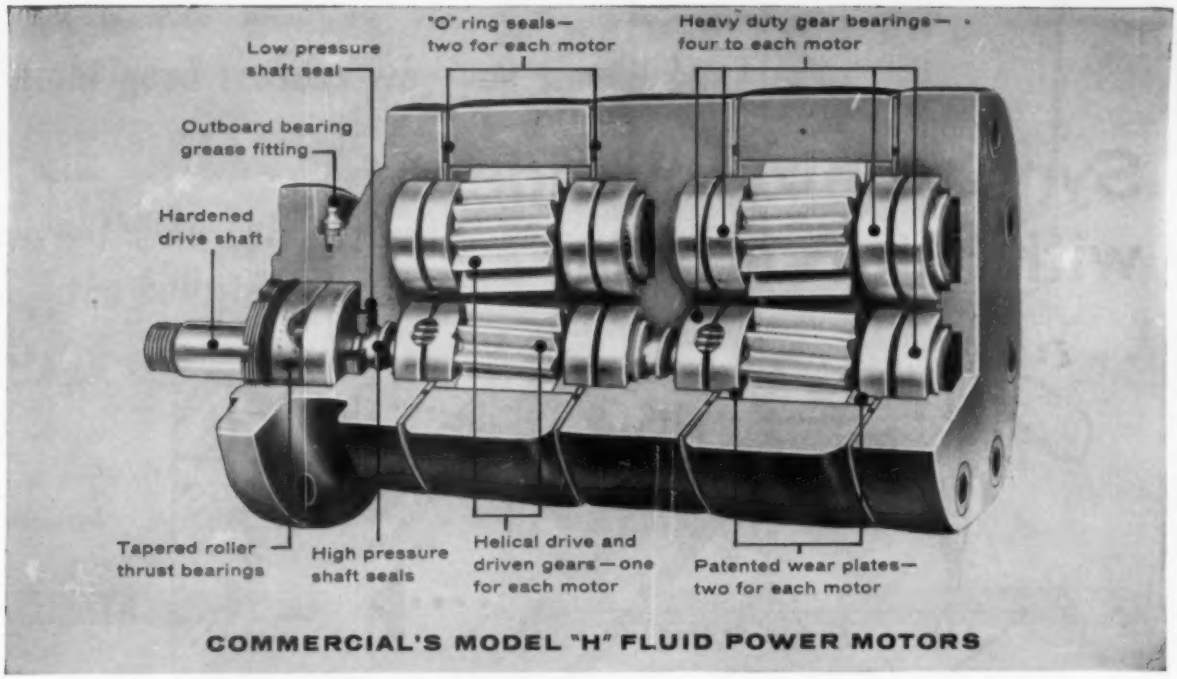
TO REDUCE inspection by separating parts, a pneumatic system was added to a screw machine. The first piece and the last two pieces machined from each bar were giving the trouble, the others were uniform.

To separate the good parts from bad, a cylinder-actuated guide was installed to direct finished parts to either of two pans. The problem was to keep the cylinder extended while good parts were being machined, and to retract it to reject the first and last pieces of the bar.

Two cam-operated valves, actuated by a lever on the bar feed mechanism, sense position of the bar. A cam on the 4-way valve is actuated when the bar moves into position for machining the next-to-the-last piece. This retracts the guide and allows the last two pieces to fall into the *bad* pan. The valve remains in position when the feed mechanism returns, so that the first piece machined from the bar also drops into the *bad* box.

As the bar moves for machining the second piece, the 3-way valve is actuated directing pilot air to the 4-way valve which shifts to extend the cylinder. □□□

This article received honorable mention in the 1958 APPLIED HYDRAULICS & PNEUMATICS Prize Paper Contest


"O" ring seals—two for each motor
Heavy duty gear bearings—four to each motor
Low pressure shaft seal
Outboard bearing grease fitting
Hardened drive shaft
Tapered roller thrust bearings
High pressure shaft seals
Helical drive and driven gears—one for each motor
Patented wear plates—two for each motor

COMMERCIAL'S MODEL "H" FLUID POWER MOTORS

New ideas in fluid power motors

Multiple-speed drive simplified

Efficient operation of heavy mobile equipment frequently involves multiple speeds. Not so efficient, however, is the shifting of gears, the power take-offs, clutches and gear transmissions involved in gaining these desired speed levels with mechanical drives—not to mention the constant maintenance headaches these same drives entail.

Pictured above is one Commercial fluid power oil-hydraulic motor that now delivers low and high speeds efficiently—completely eliminates the problems mechanical drives ordinarily involve.

Two motors work in tandem

This Commercial Model "H" tandem motor actually involves two single motors of equal output mounted on one common drive shaft. When fluid power from the pump source is directed by simple valving into just one of the single motors, the shaft rotates at the high speed. The other single motor on the same shaft receives no input and therefore merely turns. When low speed is required, the total fluid power delivery from the pump is valved into both of the single motors. And of course motor torque at this reduced speed is doubled. This simplified control of two speeds—both low and high—is possible in either direction, forward or backward.

Each of the single motors in this Model "H" tandem motor has one-inch gears. With a fluid power input of about 15 gpm at 1200 psi, for example, when one of the single motors receives the entire input, rotation is 1200 rpm. When the same input is split between the two equal size single motors, rotation is 600 rpm.

Model "H" motors are available with gears in widths of 1", 1¼", 1½", 2", 2½" and 3". Any combination of gear sizes is practical.

More than two speeds

Even three speed operation can be obtained with Commercial double tandem motors when gears of different widths are used in each single motor. High speed operation results when the full pump delivery is valved to the motor with the smaller gears, intermediate speed when it is all directed to the larger gear motor, and slow speed when valved to both motors. One single motor having three-inch gears operating at 1600 psi at a speed of 1200 rpm would develop about 50 h.p. Commercial Model "H" motors are recommended for continuous duty operation at pressures up to 2000 psi and speeds up to 1800 rpm.

Engineering help available

Be sure to send for your copy of Commercial's "Oil-Hydraulic Motors Catalog H-4". Further information on Commercial's complete line of other fluid power components—valves, pumps and cylinders—is also yours for the asking, as is technical help and assistance from Commercial on fluid power applications.

Address inquiries to The Commercial Shearing and Stamping Company, Dept. A-10 Youngstown 1, Ohio.

COMMERCIAL
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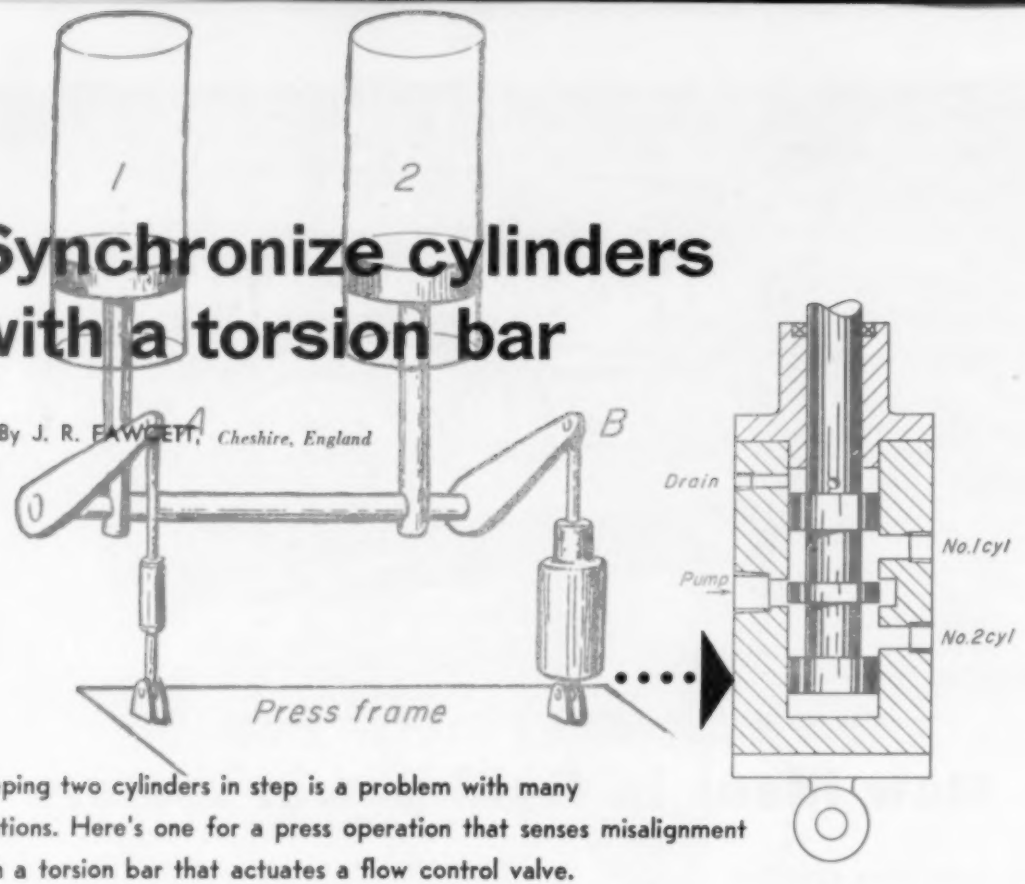
Synchronize cylinders with a torsion bar

• By J. R. FAWCETT, *Cheshire, England*



Keeping two cylinders in step is a problem with many solutions. Here's one for a press operation that senses misalignment with a torsion bar that actuates a flow control valve.

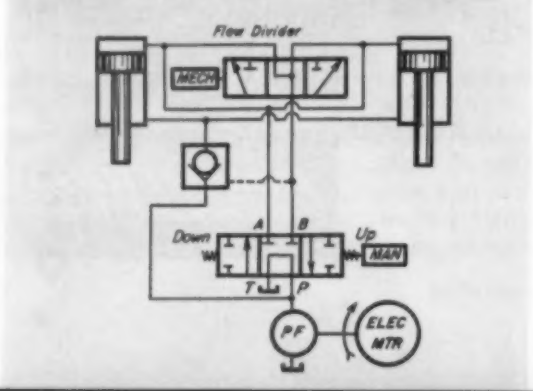
SYNCHRONIZING two cylinders with a torsion bar which actuates a flow divider is very suitable where cylinders are spaced far apart. The torsion bar is supported in close-fitting bearings, either in the cylinder rods themselves or in bosses on the rods. Each end of the bar has a crank arm fixed to it. One crank connects to the machine frame by an adjustable anchor rod, and the other connects through a flow dividing valve. As the pistons extend and retract together, the torque bar turns in the bearings, and the ends of the cranks remain approximately stationary because end *A* is anchored to the machine by the rod. However, if the pistons get out of alignment, there is a relative shift between points A and B and the flow divider is actuated.

For example, if piston 2 moves faster than piston 1, point B will be lowered a corresponding amount, and the rod of the flow divider valve will be pushed down. If piston 1 moves faster than piston 2, the torsion bar will twist, so that point B rises and the valve rod is pulled out.

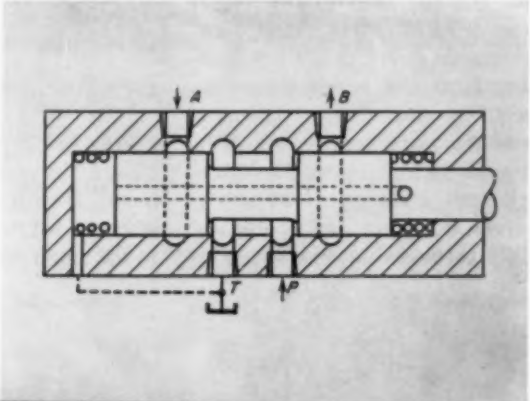
• **Circuit Operation**—The directional valve controlling the circuit has its spool arranged so that on the retract stroke of the cylinders, oil passes from the head ends to drain. This arrangement is necessary because fluid cannot pass through the flow dividing valve on the return stroke.

A pilot-operated check valve is connected in the line to the rod ends of the cylinders to maintain the pistons in the up position while the pump is unloaded. When the cylinders are extended, pressure increase opens the check valve which forms a differential circuit for greater speed. □□□

FLOW DIVIDER PORTS OIL EQUALLY to both cylinders as long as they are synchronized. Misalignment shifts valve to direct more fluid to one cylinder than the other.



DIRECTIONAL VALVE UNLOADS PUMP in center position. Shifting spool to left, blocks pump port, connects ports A and T. Shifting spool to right extends cylinders.



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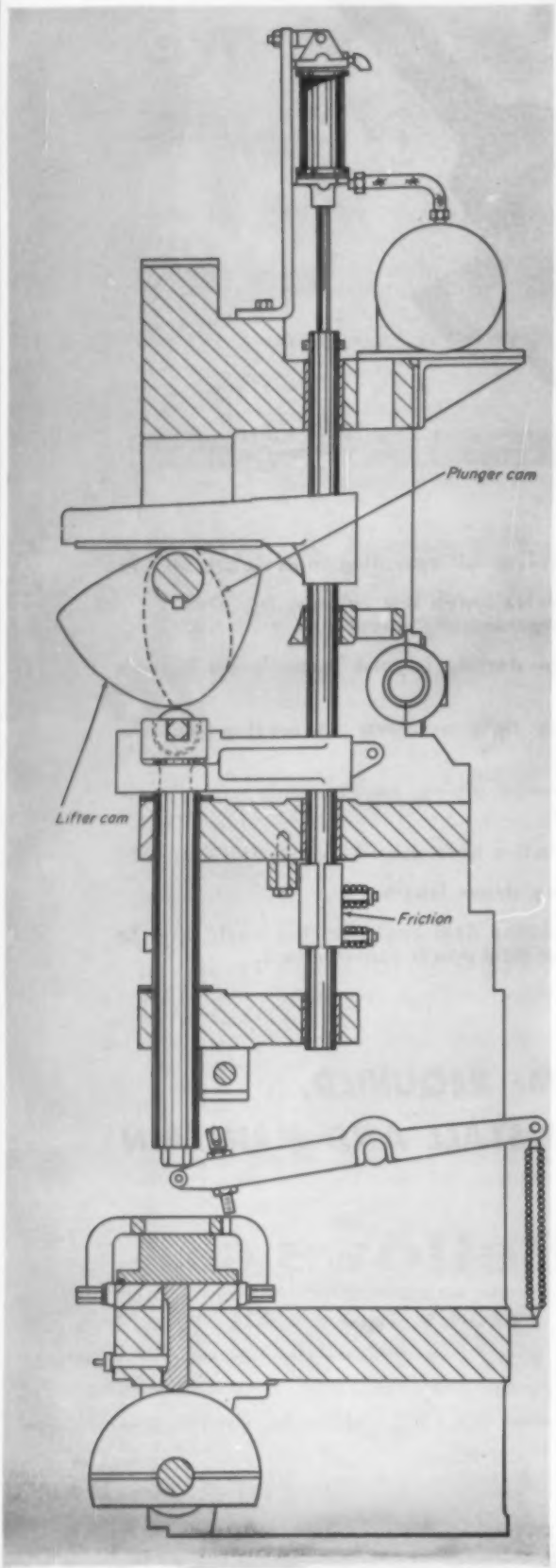

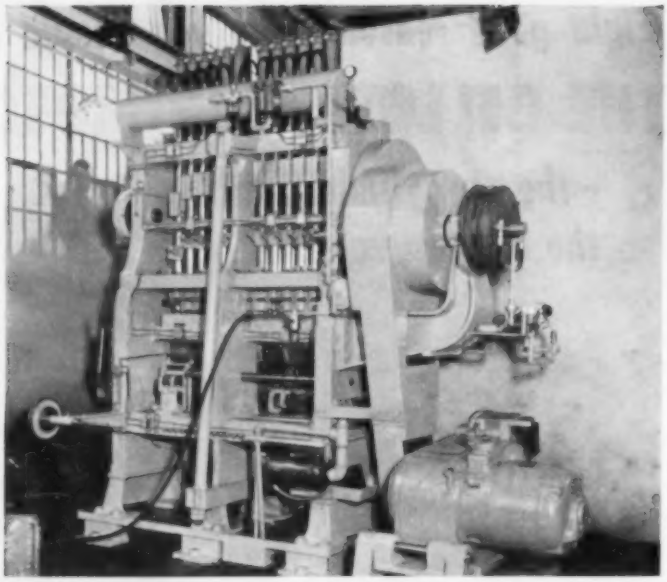

CYLINDER ROD ENDS are connected to a surge tank kept at constant air pressure. As rods extend, air regulating valve relieves excess pressure.

SEPARATE CAMS raise and lower plungers. Air cylinders counterbalance the shaft to assure cam contact and reduce horsepower requirements. Rod frictions are used to position the plungers.

Counterbalancing with air

• By RAY WALSH
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

TO AVOID keeping the lifter rod frictions on eyelet machines snubbed up tight, air cylinders were added to counterbalance the plunger assembly. Now the frictions only position the plungers. The counterbalance cylinders make the machine run smoother and save power.

An air receiver made from an 8-in. pipe serves as a supply and reservoir tank. A relief valve keeps the pressure constant.

Each station or plunger has its own pair of cams. There's one for the lifting stroke and one for the work stroke. The amount of stroke on each plunger can be adjusted.

The addition of the counterbalance cylinders not only makes the machine run smoother but also increases the life of the lifter rod frictions. □□□

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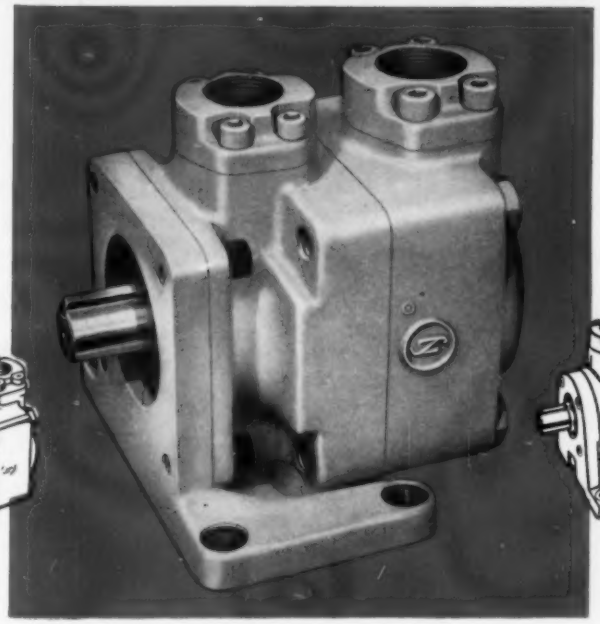

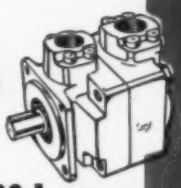

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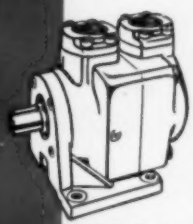

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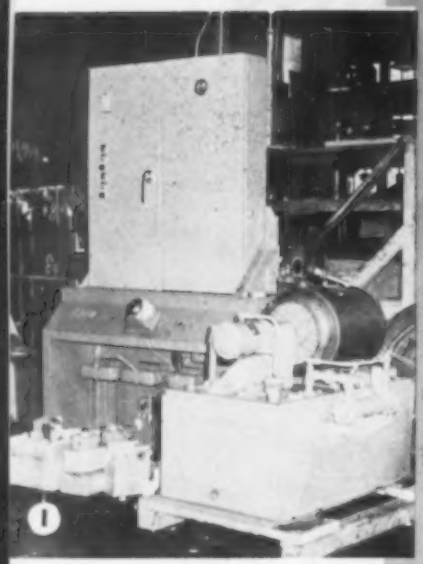
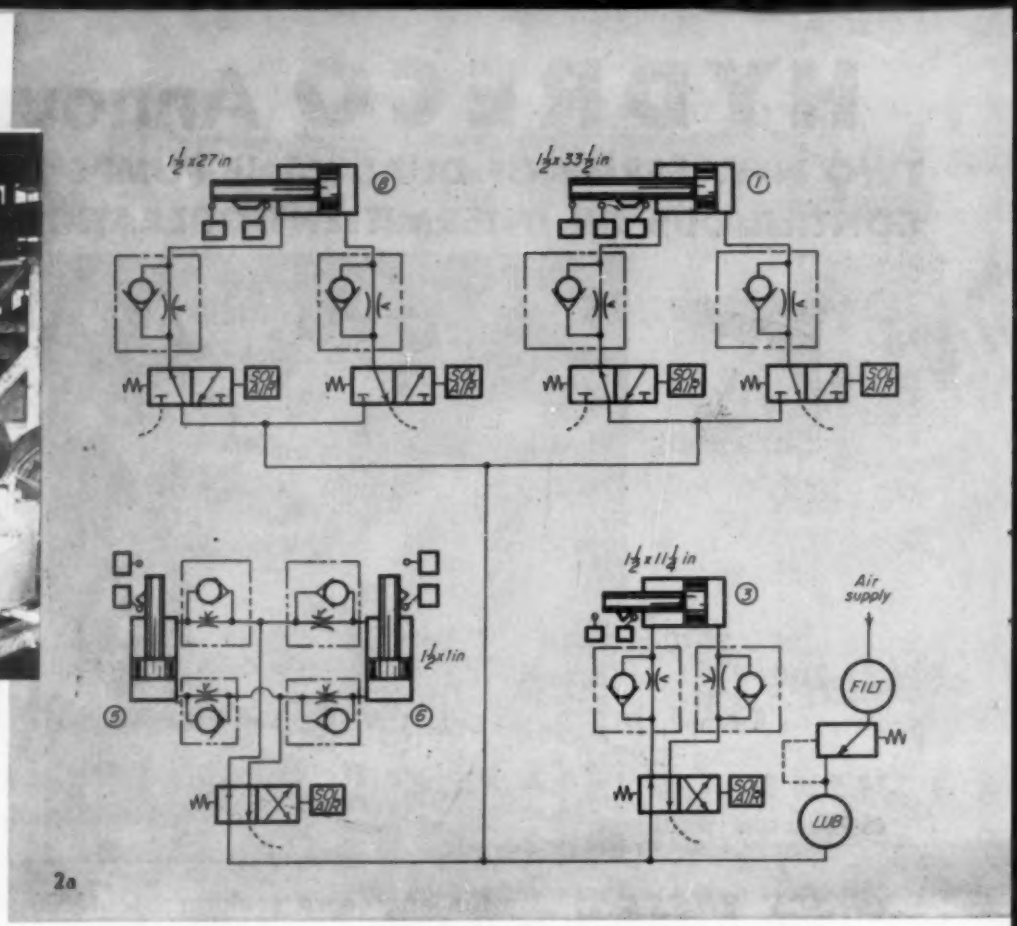




2a

Electrical controls sequence air-

• By JACK R. CLEMENS, *Asst. Dir. Engineering, TAB Engineers, Chicago, Ill.*

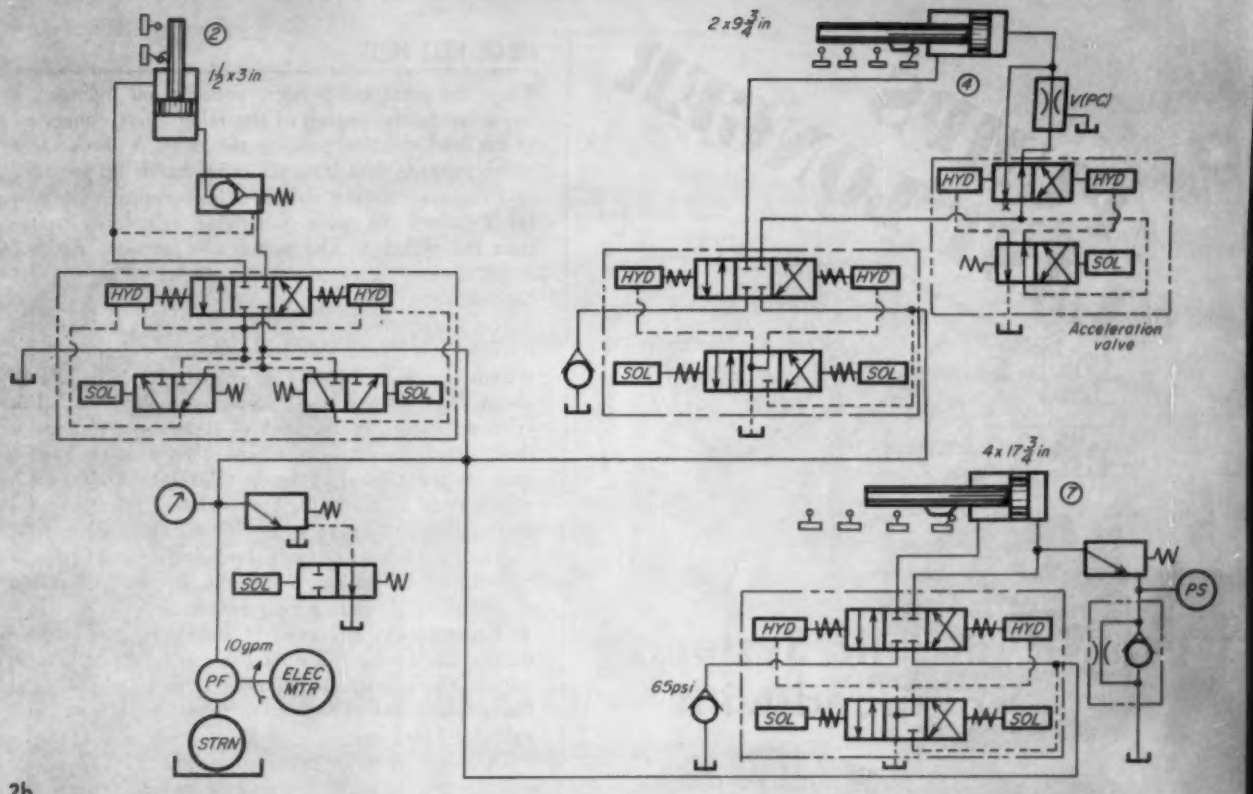
DEVELOPING a machine to press meat into blocks of uniform cross section and density was largely a matter of sequencing the air and oil cylinders which transfer and press the meat. With the interlocking and timing that was required, limit switches, timers, and pressure switches were the logical control components.

About 20,000 lb of force is required to form the rough pieces of meat into blocks which are produced at the rate of five or more blocks per minute.

The diagram illustrates the action of the machine. An operator loads meat onto a tray, and cylinder 1 pushes it onto the lower platen. Cylinder 2 then extends to press the meat against the upper platen. Cylinder 4 transfers the meat to the cavity where it is confined by cylinder 3, which closes a gate, and cylinders 5 and 6 which lock the pusher in place. Cylinder 7 compresses the meat in the cavity. After into a lower tray where it is pushed into a slicer by the gate opens, cylinder 7 extrudes the block of meat cylinder 8.

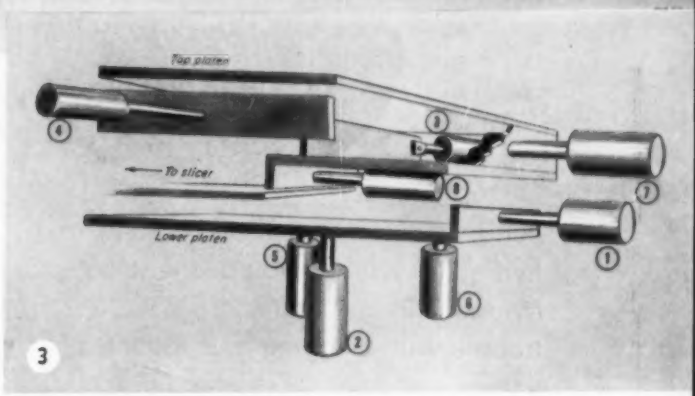
• **Operating sequence**—When the valve controlling cylinder 1 is actuated to extend the cylinder, cylinder 8 also extends to push out the block of meat previously pressed. At the end of its stroke, cylinder 8 trips a limit switch to return the cylinder. It stops when it trips its return limit switch.

At the end of its forward stroke, cylinder 1 trips a limit switch and starts to return. After it has returned about 4½ inches, it trips a 1-way limit switch (actuated in only one direction) starting cylinder 2. When cylinder 1 reaches the end of its return stroke, an amber light begins flashing to signal that the operator can load another charge. Cylinder 1 cannot be extended, however, until cylinder 2 has returned the



2b

oil meat press



3

lower platen. At the top of its stroke, the lower platen de-energizes the valve controlling cylinder 2, locking the platen in position.

When the lower platen reaches its top position, it trips a limit switch which starts cylinder 4 extending to push the meat into the cavity. When cylinder 4 trips its first limit switch after starting up, it actuates its solenoid-controlled accelerating valve. This bypasses the flow control valve in the cylinder line, so the cylinder moves forward at fast speed. When it trips the next limit switch, it deactuates the valve and slows down. At the end of its stroke, it comes up against a positive stop and trips a limit switch to extend cylinders 5 and 6, locking up the cavity.

• **Pressure control**—Cylinder 7 extends to compress the meat in the cavity. After pressing meat, it trips a limit switch to retract locking cylinders 5 and 6.

1 ELECTRICAL CONTROLS for the press are mounted in a cabinet on top of fluid power controls. A 10-gpm pump is driven by a 10-hp motor, both mounted on a 55-gal reservoir.

2 AIR SYSTEM (2a) transfers meat between stations in the meat press. Hydraulic system (2b) does the pressing. Limit switches actuate most valve operations.

3 DIAGRAM OF CYLINDER MOTIONS shows air cylinders 1, 3, 5, 6, and 8. Hydraulic cylinders are numbered 2, 4, and 7.

AIR-OIL MEAT PRESS

When the meat compresses, pressure on cylinder 7 builds up to the setting of the relief valve connected to the head-end line, opening the valve. A check valve which restricts flow from the relief builds up pressure to actuate a pressure switch. The pressure switch in turn actuates the valve controlling cylinder 7 to retract the cylinder. The switch also actuates a timer which times out to stop the cylinder after a short back off.

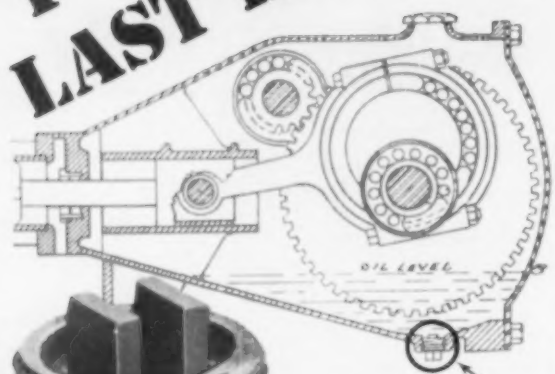
The timer also makes the gate open (cylinder 3 retracts). With the gate fully open as determined by a limit switch, cylinder 7 moves forward all the way about 1½ inch past the gate, onto a lower tray. When cylinder 7 reaches the end of its stroke, it trips a limit switch to start its return. When it clears the gate on the return stroke, it releases a limit switch which stops it, starts the lower platen down, and extends cylinder 8.

When the lower platen is down, cylinder 4 starts to retract. At its full back position, it starts retraction of cylinder 7 through a limit switch.

• **Emergency reverse**—If anything goes wrong during the cycle, the operator can press a reverse button which retracts cylinders 1, 5, 6, and 8. The lower platen also lowers, cylinder 4 retracts, and cylinder 7 returns.

Cylinder 7 can be operated individually by selecting this operation with a selector switch. The switch can also select operation for pressing meat only, without feeding it through the slicing conveyor. □□□

PUMPS LAST LONGER



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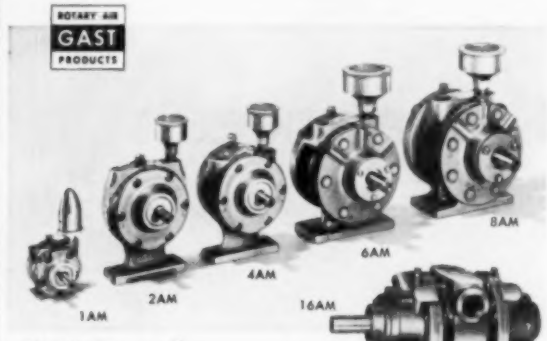

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Model No.	H.P. at 90 PSI 2000 RPM	Weight lbs.
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2AM	0.57	5½
4AM	1.1	8
6AM	2.0	17
8AM	4.0	25
16AM	7.0	65

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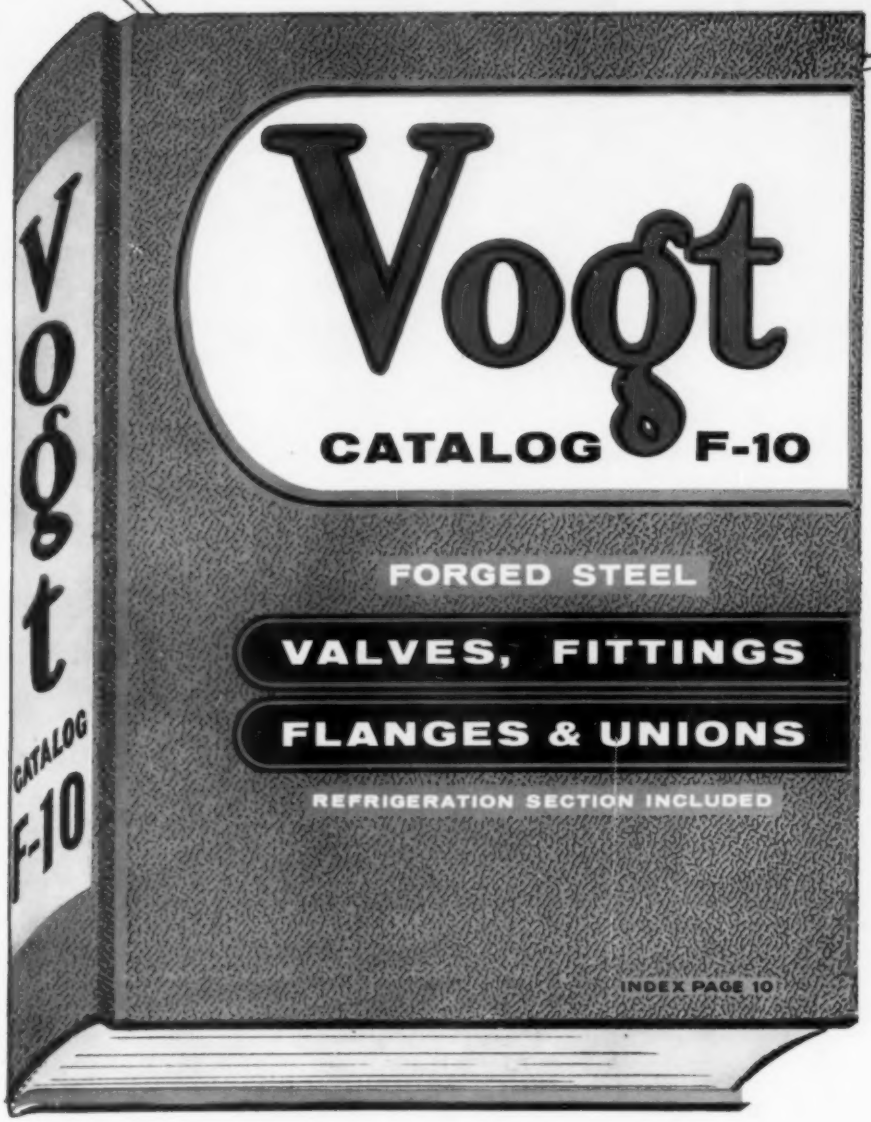

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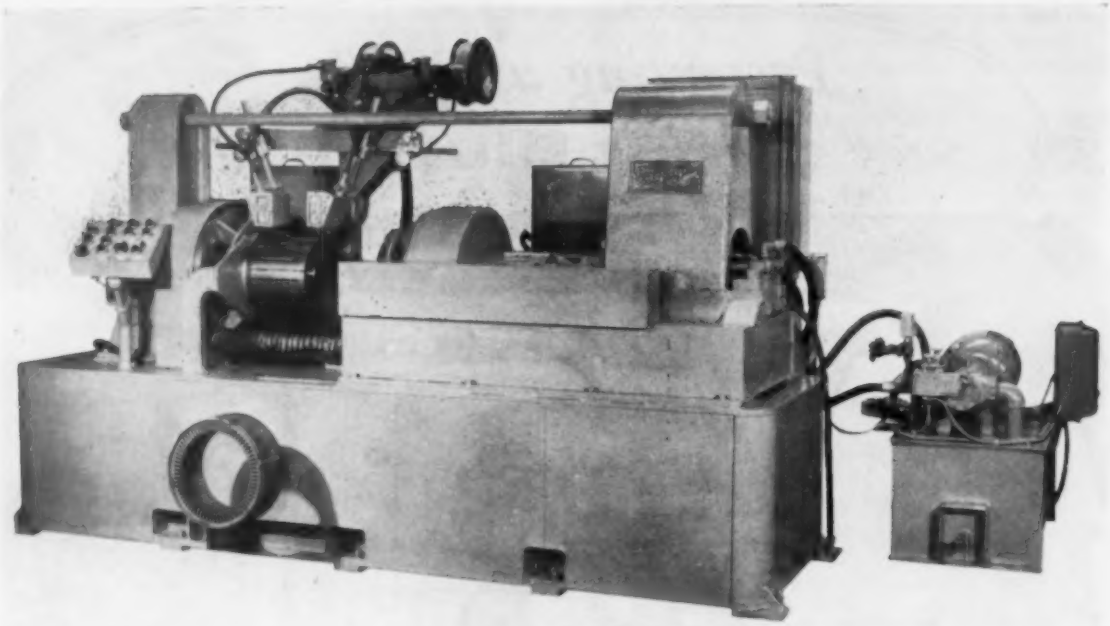

REAR VIEW of core press and welding machine shows hydraulic power pack at right and the finished stator core at the left.

Pilots trigger relief valve

• By GEORGE MAC LEAN, *Design Engineer, Cayuga Machine & Fabricating Co., Inc., Depew, N. Y.*

Versatile 2-pump circuit has three pilot sections that control the relief valve on the pump valve panel. Any pressure from 0 to 2000 psi can be directed to the high or low pressure circuit.

STATOR cores are made up of loose laminated stampings, located on an expanding mandrel. An end ring is placed on each end of the laminated stack. The assembly is then pressed hydraulically at 25 tons to seat the punchings and give a tight core. The motor core bore is sized by the expanding mandrel at 6 tons expanding pressure. A strap is then placed across the laminated stack, and the core is rotated under two welding torches. As the strap moves under the torches, a weld is performed on each end, welding it to the two end rings. Rotation continues until 6 straps are welded across the core. The completed core is then automatically ejected off the mandrel, and rolled to a conveyor behind the machine.

• **Circuits considered**—The first plan was to use a normal 2-volume pumping unit for fast positioning, then as the pressure increased, unloading the high volume pump, and maintaining the low volume, high pressure pump to give the 25-ton force. However since the motor core had to rotate under pressure, the 25-ton thrust on the cone bearing made a high torque requirement from the rotation driver.

Although it took 25 tons to seat the laminations, it was felt that 15 tons would hold it, and the core quality would be improved. The torque requirements of the drive motor were also reduced.

On the basis of the reduced pressure, a new hydraulic circuit was designed, again using the normal 2-volume pumping unit, with the addition of the necessary relief valving. The new circuit was made up of three pilot sections controlling the integral relief valve on the pump valve panel.

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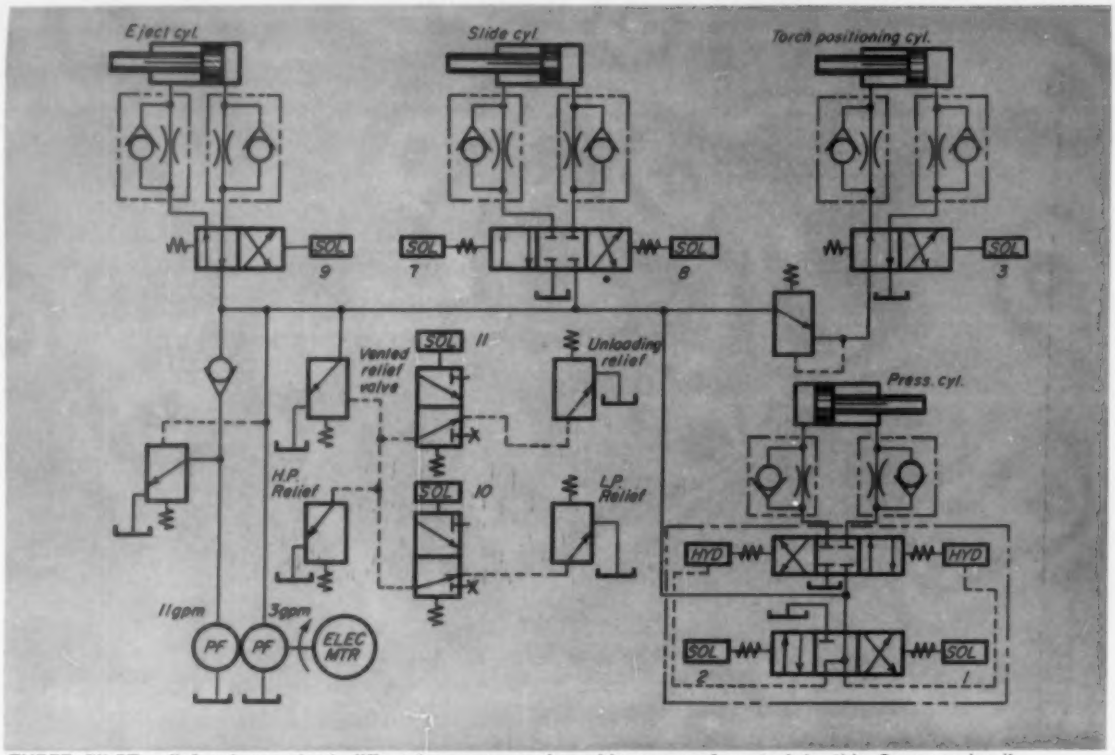

THREE PILOT relief valves set at different pressures give wide range of control to this 2-pump circuit.

By raising the line pressure to 2000 psi, the work cylinder, pump, and reservoir size reduced enough so that a 7½-hp, 1800-rpm electric motor could be used. At 1000 psi, a 20-hp, 1200 rpm motor was needed.

• **Circuit operation**—Before starting the work cycle, the pump is unloading, solenoid 10 is energized, and solenoid 11 is de-energized. Solenoid 11 causes the low volume pump to unload to tank, through the venting relief valve pilot section, while keeping the pressure high enough in the low-volume line to operate the unloading valve for the high-volume pump.

After loading the machine, a pushbutton energizes solenoid 11 blocking the relief valve pilot section, allowing both pumps to deliver to the work. Solenoid 1 is also energized permitting the combined flow to extend the press cylinder.

As pressure increases, flow from the high-volume pump is dumped through the unloading valve. The low-volume pump continues to deliver at 1800 psi, the setting of the high-pressure relief valve pilot.

An electrical timing circuit times-out to de-energize solenoid 10, opening the venting relief valve at 1500 psi, the setting of the low pressure relief valve pilot.

A manual pushbutton energizes solenoid 3 extending the torch positioning cylinder. A pressure reducing valve is used in this section of the circuit, because the torch positioning cylinder has a maximum operating pressure of 750 psi.

Core rotation is started electrically as the torch moves into position. After one revolution, rotation is automatically stopped, solenoids 1 and 3 are de-energized, and solenoid 2 is energized retracting the press and torch positioning cylinders.

When the press cylinder is fully retracted, solenoid 7 is energized, extending the slide positioning cylinder. The slide in position energizes solenoid 9 retracting the eject cylinder. The core is ejected on the slide and rolls out the rear of the machine.

With the ejector extended, an electrical timing circuit times out to de-energize solenoid 7 and energize solenoid 8, retracting the slide cylinder. Movement of the slide over a limit switch de-energizes solenoid 9, returning the ejector. When the ejector reaches back position, it de-energizes solenoid 11 and unloads the pump. □□□

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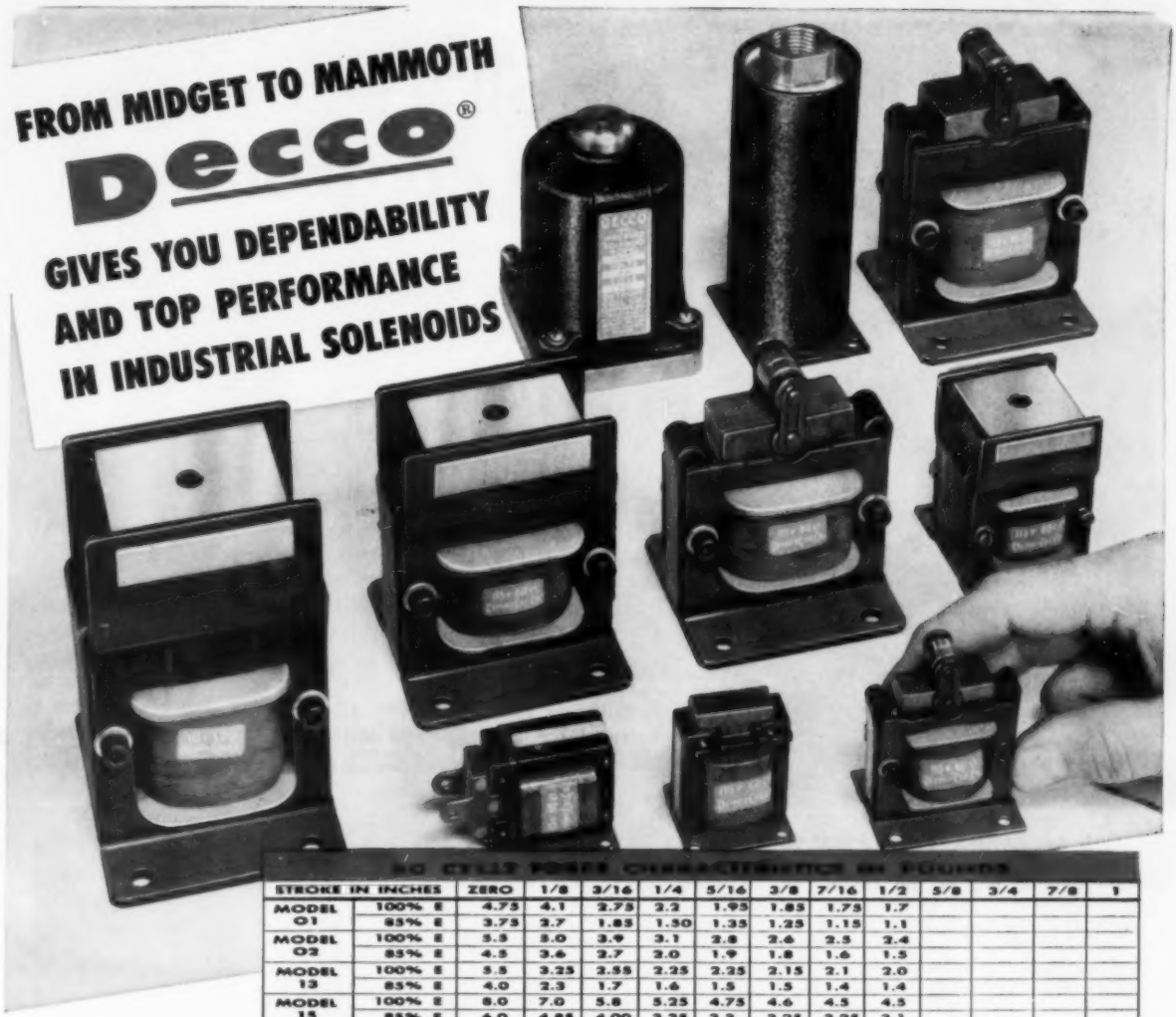

AC CYCLE POWER CHARACTERISTICS IN POUNDS

STROKE IN INCHES		ZERO	1/8	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1
MODEL 01	100% E	4.75	4.1	3.75	3.2	1.95	1.85	1.75	1.7				
	85% E	3.75	3.7	1.85	1.50	1.35	1.25	1.15	1.1				
MODEL 02	100% E	5.5	5.0	3.9	3.1	2.8	2.6	2.5	2.4				
	85% E	4.5	3.6	2.7	2.0	1.9	1.8	1.6	1.5				
MODEL 13	100% E	5.5	3.25	2.55	2.25	2.25	2.15	2.1	2.0				
	85% E	4.0	2.3	1.7	1.6	1.5	1.5	1.4	1.4				
MODEL 15	100% E	8.0	7.0	5.8	5.25	4.75	4.6	4.5	4.5				
	85% E	6.0	4.85	4.00	3.35	3.3	3.25	3.25	3.1				
MODEL 16	100% E	12.0	8.5	7.15	6.75	6.6	6.5	6.5	6.4				
	85% E	10.0	6.1	5.15	4.75	4.6	4.5	4.5	4.5				
MODEL 17	100% E	16.0	11.2	9.9	9.0	8.5	8.1	8.0	8.0				
	85% E	14.0	8.2	7.0	6.3	6.2	6.1	6.0	6.0				
MODEL 18	100% E	18.5	14.5	12.25	11.4	11.0	10.5	10.25	10.25				
	85% E	16.0	10.5	9.0	8.25	7.75	7.5	7.25	7.25				
MODEL 20	100% E	25.0	18.0		13.5		12.5		12.5	12.5	12.25		
	85% E	20.0	12.0		9.0		8.5		8.5	8.5	8.5		
MODEL 21	100% E	35.0	20.0		16.0		15.0		15.0	15.0	15.0		
	85% E	25.0	14.0		10.5		10.25		10.0	10.0	10.0		
MODEL 31	100% E	40.0			23.0		21.0		20.0	20.0	20.0	20.0	20.0
	85% E	30.0			17.0		15.5		14.5	14.5	14.5	14.5	14.5
MODEL 32	100% E	45.0			28.0		25.0		25.0	25.0	25.0	25.0	25.0
	85% E	33.0			19.0		17.0		17.0	17.0	17.0	17.0	17.0
MODEL 33	100% E	50.0			37.0		32.0		30.0	30.0	30.0	30.0	30.0
	85% E	36.0			25.0		22.0		20.0	20.0	20.0	20.0	20.0

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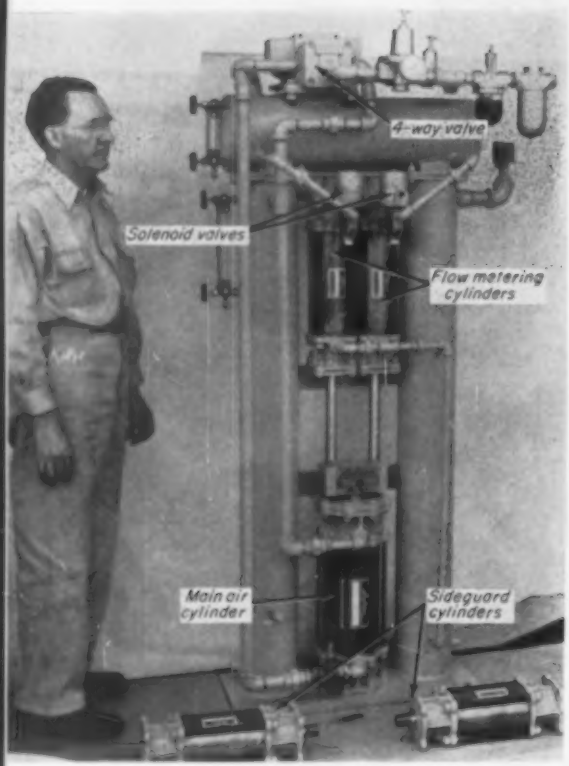


Air-oil edge control

• By ALEXANDER A. TOBEN,
Director of Engineering, Ledeen Mfg. Co., El Monte, Calif.

A MASTER-slave system maintained at constant pressure keeps sheet steel centered as it runs into an edge trimmer. A double-acting air cylinder drives two hydraulic master cylinders which meter equal flow to slave cylinders.

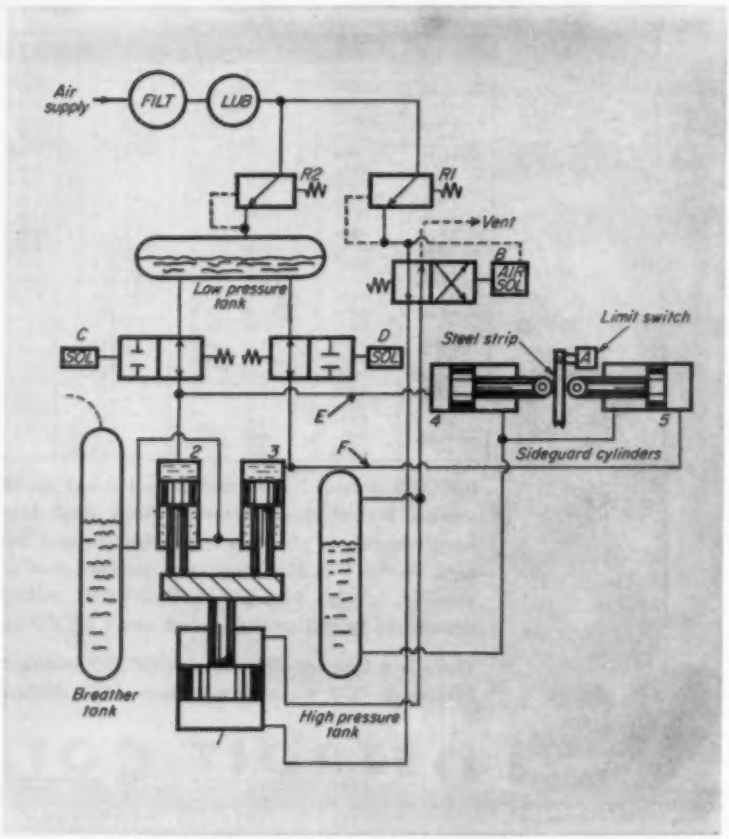
Air-hydraulic operation eliminates the mechanical rigidity of electrically operated units which don't give with width changes. Immediate response permits high speed rolling, there's no waiting for the operator to readjust sideguard rollers. There's no buckling of steel sheet. The air-oil circuit requires less maintenance than a mechanical system because parts are naturally lubricated and slow moving. □□□

WHEN OPERATING, solenoid shut-off valves **C** & **D** are closed and low pressure tank is out of the circuit. Air pressure is directed to the bottom of cylinder 1. As the cylinder moves up, hydraulic cylinders 1 and 2 also move up, forcing equal amounts of oil to the blank ends of sideguard cylinders 4 and 5.

An uneven width of sheet steel forces the sideguard cylinders in and out. They move equally, because they are connected by closed hydraulic circuits **E** and **F** to cylinders 2 and 3 which are connected with a tie-bar. Thus the sheet remains centered.

Force on edge of sheet is constant because cylinder 1 maintains a constant force set by pressure regulator R1.

To change entire position of sheet, operator de-energizes solenoid valve **C** or **D** and bleeds some oil from the respective line to the low pressure tank. Cylinder on opposite side forces sheet to move in proportion to the amount of oil bled. When strip runs out, switch **A** is de-energized, valve **B** reverses, and valves **C** and **D** open. This opens the sideguard cylinders and refills hydraulic lines **E** and **F**. When the next strip hits switch **A**, sideguard cylinders close and center the strip for the next run.



NEW SOLENOID VALVES *by Airmatic*

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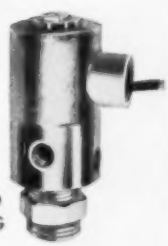
SPECIFICATIONS		
	TWO-WAY	**THREE-WAY**
CATALOG NO.	91011	91011
PRESSURE RANGE	1/16" ORIFICE: 0-500 PSI 3/16" ORIFICE: 0- 70 PSI	1/8" ORIFICE: 0-300 PSI 3/16" ORIFICE: 0-100 PSI
ORIFICES	1/16" THROUGH 3/16"	1/8" AND 3/16"
VOLTAGE	MOST A-C AND D-C	MOST A-C AND D-C
DUTY	CONTINUOUS	CONTINUOUS
POWER CONSUMPTION	10 - 20 WATTS	10 - 20 WATTS
HEAT RISE	WITHIN UL LIMITS	WITHIN UL LIMITS

OPTIONAL DESIGNS

MANUAL OVER-RIDE



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Discuss fluid power at

CYRIL BATH ENGINEERS supplied the answers to questions on design practices and future plans for fluid power systems. From left to right they are Karl Schreeck, Peter Mathews, (AH & P editor Allan Morris), James Peterson, and George Perkins.

Recently editors of APPLIED HYDRAULICS & PNEUMATICS *met with engineers at Cyril Bath Co. to discuss design ideas in using hydraulics and pneumatics. As leading manufacturers of radial draw forming machines Cyril Bath designers are well qualified to give their views on present practices and future needs. Here's a brief run-down on the discussion.*

- **What are you doing to improve efficiency?**

It is not uncommon for our machines to idle for two to three hours between operations, and we now use a solenoid operated unloading valve to direct pump output back to tank at low pressure. We are considering a pressure-compensated, piston type pump for better efficiency. Possibly this will eliminate heat exchangers on our machines. Our pumping capacity ranges from 40 to 60 gpm at present, and machines now in development will probably require 100 gpm.

- **What steps have you taken to minimize leakage?**

Actually we are not very troubled by leakage. We do realize advantages of manifolds in eliminating leak-

Cyril Bath

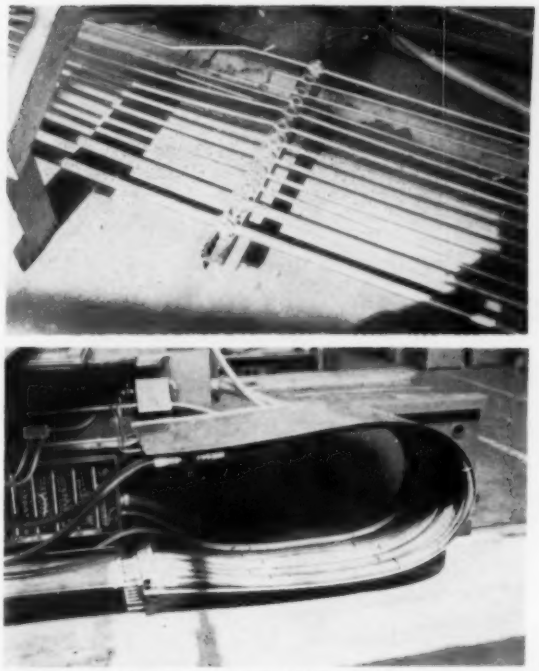
age points, but our machines are not standardized to the point where we can use them. For our tube connections we are using a compression type fitting, because we have found these better than flare fittings under severe vibration.

- **What special methods have you developed for pressure control?**

Our electronic tension control system regulates pressure by actuating a motorized relief valve to maintain tension at the yield point in the work being formed. Since pressure control is so critical on our machines, we are eliminating hose in favor of tubing, and we are getting rid of a pressure hunting problem. We are also investigating the use of smaller pumping units placed at strategic points on the machine to eliminate running lines from one central pumping unit.

- **How do you design for temperature control?**

Fortunately in this respect we have a lot of fluid lines giving a large area to dissipate heat. We believe in very large reservoirs and do not limit ourselves to the recommended 3:1 ratio in relation to pump delivery. □□□



TWO DESIGNS TO PROTECT LINES. Good line support shown at top cuts down leakage due to vibration. Metal cover shown below flexes with hose lines, gives protection in any position.

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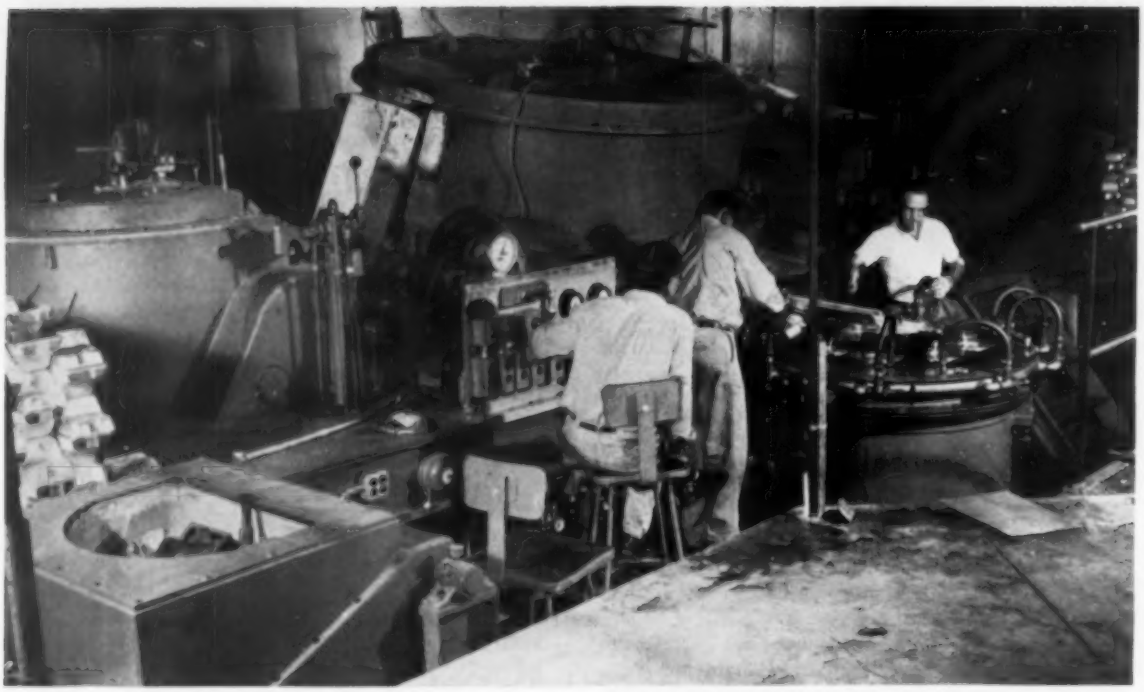


FURNACE TILTING SPEED must be regulated according to casting speed of aluminum billets. Both of these speeds depend on hardening rate of the metal, and must be closely controlled. Installation is at Himmel Bros. Hamden, Conn.

Fine tilt speed for a furnace

• By J. L. HOFF, *Chief Engineer, Ajax Engineering Corp. Trenton, N. J.*
and R. P. RANKIN, *Walter A. Rankin Co., Drexel Hill, Pa.*

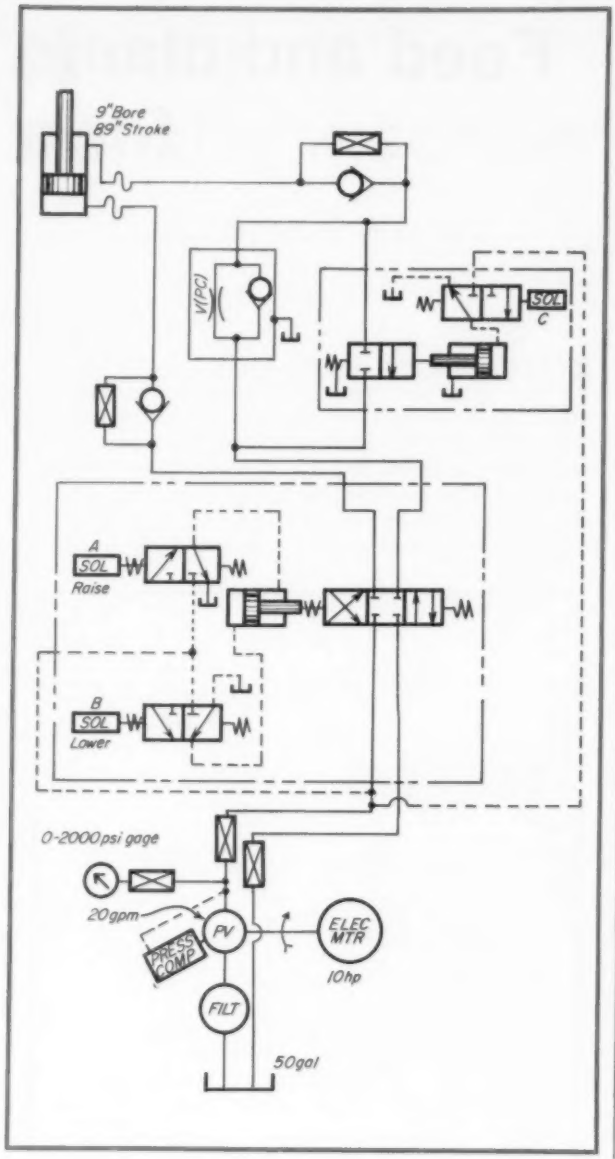
Pressure-compensated flow control valves keep speed constant even when load changes. The one in this system can be accurately set to meter 10 cu. in. to 4 gpm.

CONTINUOUS casting of aluminum billets for extrusion requires fine tilt control of the furnace which pours molten metal into a casting machine. Pouring must be smooth, and the speed at which the furnace is tilted must be easily controlled and accurately set at a pre-selected rate corresponding to the hardening of the metal.

The casting machine has cavities arranged in a circle with a manifold to distribute the molten metal as it enters. As the metal hardens in the water cooled cavities, cylinder pistons which support it, retract. The speed of these pistons must also be carefully controlled so that it is not faster than the hardening of the metal. If the cylinders retracted too fast, molten metal would flow from the bottom of the molds. This would form a *bleeder* which would have to be scrapped.

Speed of metal entering the molds must match that of the cylinders which support the castings, so the molds are kept filled as the casting is withdrawn.

A pressure-compensated flow control valve was selected to regulate speed of the single cylinder which tilts the furnace for pouring. This insures constant cylinder speed even though load changes as metal is poured out and the furnace angle changes. Where pouring must be very uniform, the furnace must be



TILTING CIRCUIT is electrically controlled by push-buttons which actuate solenoids. Solenoids **A** and **B** are actuated alternately to tilt and lower the furnace. Solenoid **C** is actuated for fast tilt before pouring.

specially designed, so that equal volumes of metal are displaced from the furnace with equal increments of tilt cylinder extension.

The flow control valve is connected in a meter-out circuit to control flow out of the rod end of the cylinder. An integral check valve permits free return flow for quick leveling of the furnace which is recharged from melting furnaces at each side.

To speed up operation, a 2-way, solenoid-controlled, pilot-operated valve is connected to bypass the flow control. It is actuated for fast tilting until the metal begins to pour. □□□

Connect up with L and L

The Complete Line of Steel Fluid Power Couplings

JIC Flare Tube — Pipe Threaded
Flare Tube — Straight Thread "O" Ring
Flange Mounted — "O" Ring Seal

A—JIC Flare Tube Fittings
B—Manifold Fitting
C—Needle Valve
D—Pipe Nipple
E—Flange Manifold
F—Straight Thread, "O" Ring Seal Fitting
G—Ball Check Valve
H—Lateral Outlet Fitting
I—Universal Elbow
J—Dryseal Pipe Fitting
K—Hex Reducing Bushing
L—Swivel Elbow
M—Barbed Hose Stem

You can depend on L & L's quality, availability, and selection of steel couplings for piping all industrial hydraulic circuits.

Distributors in principal cities
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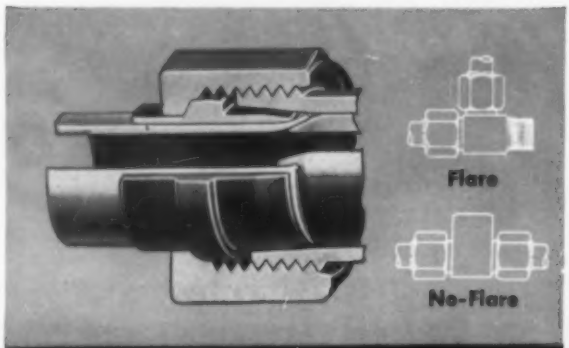
L and L MANUFACTURING COMPANY
8088 E. Nine Mile Rd., Van Dyke, Mich.

Circle **83** on *Time-Saver Card*

NOW! Get the advantages of both FLARE and NO-FLARE Fittings with . . .



FLODAR'S Combination Self-Flare Tube Fittings

The Easy Installation Of A No-Flare Fitting — no time consuming flaring operation — no flaring tools required. Can be used with heavy-wall tubing and, provides a seal on the OD of the tube.

The Efficiency Of A Flare Fitting — Can be used on thin wall tubing — provides a seal on the ID of the tube.

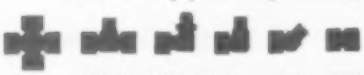
- Easy Assembly — "Rock Bottom" stop signals that joint is sealed.
- Double Seal — seals on both OD and ID of the tube.
- Lower Cost — FLODAR'S Self-Flare fittings cost less to buy and install.

You can gain the advantages of both flare and no-flare fittings with none of the disadvantages . . . when you switch to FLODAR Self-Flare tube fittings.

Tube shearing and work hardening are eliminated . . . FLODAR Self-Flaring fittings can be reassembled time after time without fear of leakage or damage to tube and fitting.

Priced competitively, this fitting is available in tube sizes from ⅛" to 2" and in steel, stainless, brass and aluminum.

Send for a copy of FLODAR'S tube and pipe fitting catalog.



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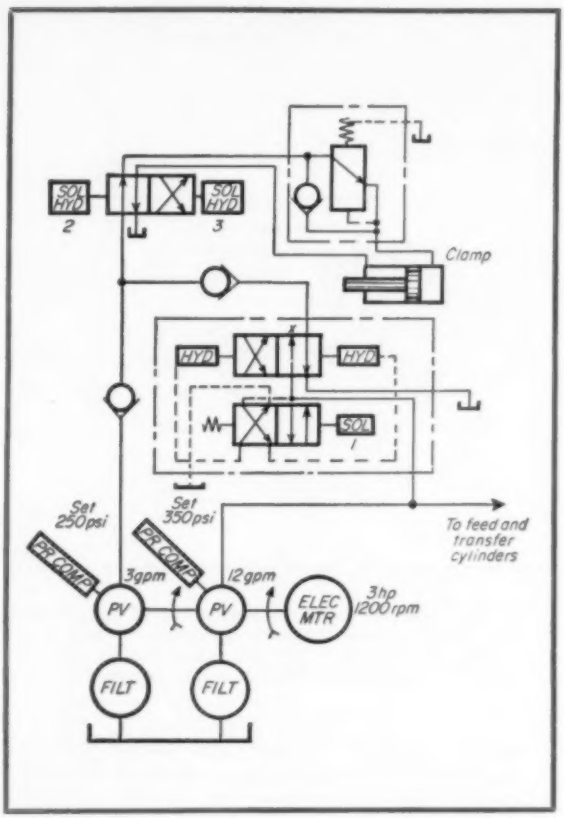
Circle **52** *on Time-Saver Card*

Feed and clamp for a

• BY DAVID W. JUNTTILA, *Controls Engineer.*

FAST clamping at a lower pressure than required for other operations; rapid traverse and feed on both extend and retract: these are some of the circuit features of a transfer machine for automotive pistons. Designed by engineers at F. Joseph Lamb, the machine bores the wrist pin hole, drills a processing hole in the balance bosses and oil holes in the wrist pin bore, mills two slots, rough mills two balance bosses, and



FAST CLAMPING is obtained by using 12-gpm pump. After clamping, solenoid 1 is de-energized and 3-gpm pump maintains clamping pressure. Single-solenoid, 4-way valve was needed because feed and transfer required higher pressure than clamping. Pressure reducing valves at each clamp cylinder keep proper clamping pressure regardless of other operations or tooling set up.

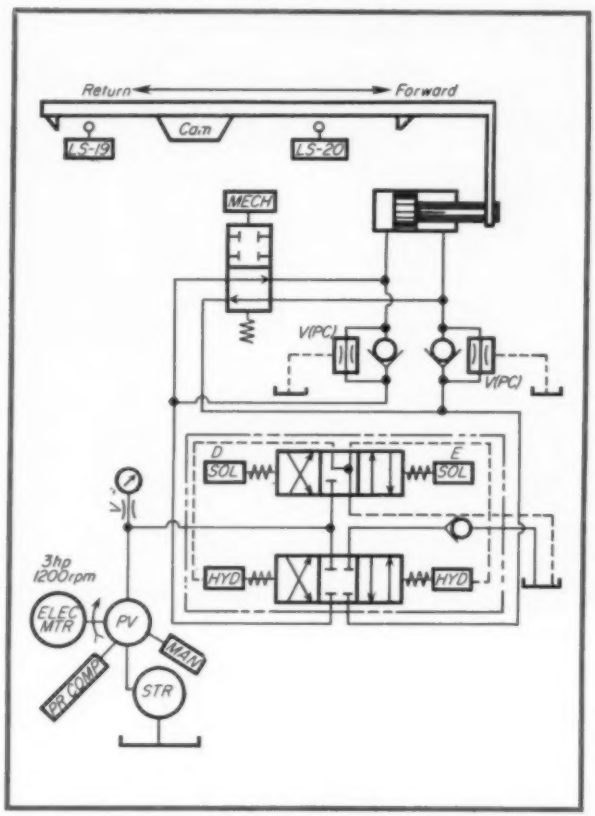
circuits transfer machine

F. Joseph Lamb Co., Detroit, Mich.

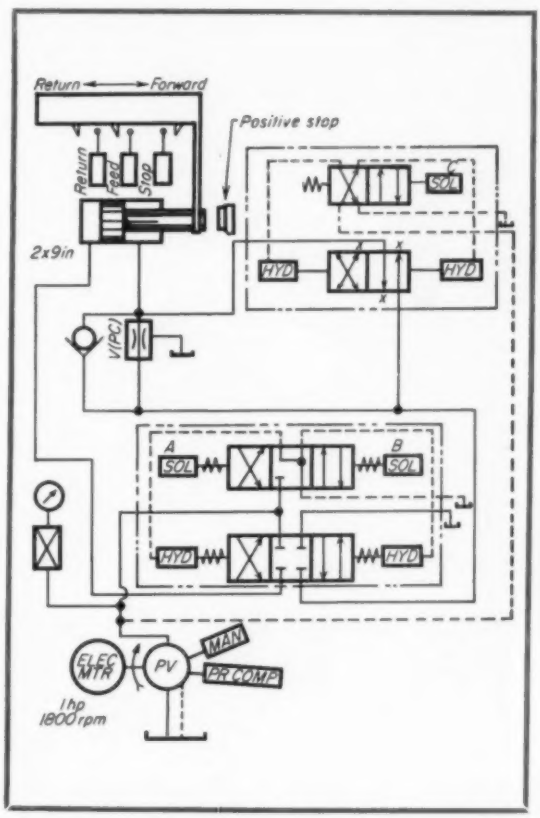
rough and finish mills two angular flats on the piston dome.

Transfer between stations is by a walking beam type bar actuated by two cylinders, one for horizontal motion, the other for vertical motion. To eliminate shock, the bar is decelerated in each of its four movements. Most of the valves are mounted on drilled manifolds to minimize leakage. □□□

26-STATION MACHINE produces 420 pistons per hour. Control valves for rapid traverse and feed in both directions are circled. Pressure reducing valves (lower circle) regulate individual clamp pressures to protect the part and to prevent variations when other clamps are operated.



CAM ARRANGEMENT gives rapid traverse, feed, and rapid clearance (traverse) in both directions. Flow control valves adjust for equal feed in both directions with single rod-end cylinder. Space limitations prevented using double rod-end cylinder. Four-way valve was modified to make deceleration valve which forces oil through flow control valves on extension and retraction of cylinder. Check in return line keeps lines full of oil and prevents jump when starting. Valves are mounted on drilled manifold for leakage control.



LIMIT SWITCHES sequence rapid forward (350 ipm), feed (0.40 ipm), dwell, and rapid return (480 ipm). Solenoid C is actuated with solenoid A to bypass flow control valve for fast traverse. Feed limit switch deactuates solenoid C, forcing return oil through flow control valve. Return limit switch deactuates solenoid A and dwell timer to stop slide. When timer times out, it actuates solenoid B for fast return.

Table I—SAE 100R2 Hose Characteristics

INSIDE DIAM (IN.)	OUTSIDE DIAM (IN.)	MINIMUM BURST (PSI)	WORKING PRESSURE (PSI)
1/4	11/16	20,000	5,000
3/8	27/32	16,000	4,000
1/2	31/32	14,000	3,500
3/4	1-1/4	9,000	2,250
1	1-9/16	7,500	1,875
1-1/4	2	6,500	1,625
1-1/2	2-1/4	5,000	1,250
2	2-3/4	4,000	1,000

Table II—3-Wire Compensated Braided Hose Characteristics

INSIDE DIAM (IN.)	OUTSIDE DIAM (IN.)	MINIMUM BURST (PSI)	WORKING PRESSURE (PSI)
3/16	41/64	30,000	7,500
1/4	45/64	28,000	7,500
5/16	49/64	25,000	6,250
3/8	55/64	22,000	5,500
1/2	1-1/32	20,000	5,000
5/8	1-5/32	18,000	4,500
3/4	1-17/64	16,000	4,000
1	1-33/64	11,000	2,750
1-1/4	1-61/64	10,000	2,500
1-1/2	2-13/64	9,000	2,250
2	2-53/64	9,000	2,250

Table III—4-Wire Spiral Hose Characteristics

INSIDE DIAM (IN.)	OUTSIDE DIAM (IN.)	MINIMUM BURST (PSI)	WORKING PRESSURE (PSI)
3/4	1-7/16	20,000	5,000
1	1-3/4	16,000	4,000
1-1/4	2	14,000	3,500
1-1/2	2-1/4	12,000	3,000
2	2-3/4	9,000	2,250

Table IV—6-Wire Spiral Hose Characteristics

INSIDE DIAM (IN.)	OUTSIDE DIAM (IN.)	MINIMUM BURST (PSI)	WORKING PRESSURE (PSI)
3/4	1-9/16	28,000	7,000
1	1-29/32	22,000	5,500
1-1/4	2-5/32	17,000	4,750
1-1/2	2-13/32	15,000	3,750
2	2-15/16	12,000	3,000

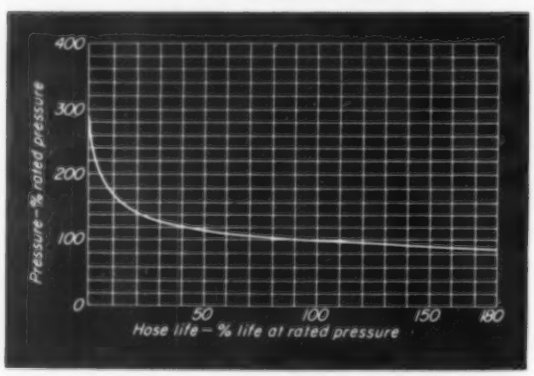


FIG. 1. Hose life versus percent of working pressure. Operation at a pressures only a little above working pressure really shortens hose life.

New hose construction for higher pressures

• By ROBERT W. PHILLIPS
Staff Engineer for Hose Fittings, Parker Fittings & Hose Div., Parker-Hannifin Corp., Cleveland

HOSE for operation at pressures above 3000 psi, in fact hose for operation to 3000 psi in large sizes, is somthing that's needed but has not, so far, been available. Two new types of hose are being developed to fill this need. One uses a new method of braiding the wire reinforcement that lets the braid work better. This is called compensated braided hose. The other type uses alternately-wound spiral layers to give full coverage of the tube so it cannot be extruded through voids. Hose using a combination of spiral layers and braiding is also being tried. Indications are it will be successful. Pressure characteristics and sizes of the compensated-braid and spiral-braid hose are listed in Tables II, III, and IV. Characteristics of SAE 100R2 double-wire-braid, rubber-covered hydraulic hose are given in Table I for comparison.

• **Fittings**—Hose ends for high-pressure hose are, of course, as important as the hose itself. Their development is a challenge. Fittings can be designed to have the necessary grip, but attaching them may be a problem. Since the biggest need for high-pressure hose assemblies is in sizes of 1-in. ID and larger, attachment may have to be done with machines because tightening torques will be so high.

• **In the Meantime**—Until these better high-pressure hoses are available, there are certain things that should be done to get the best from hose.

1. **Don't overpressure** the hose. Figure 1 shows how increased pressure shortens hose life.

Circle 133

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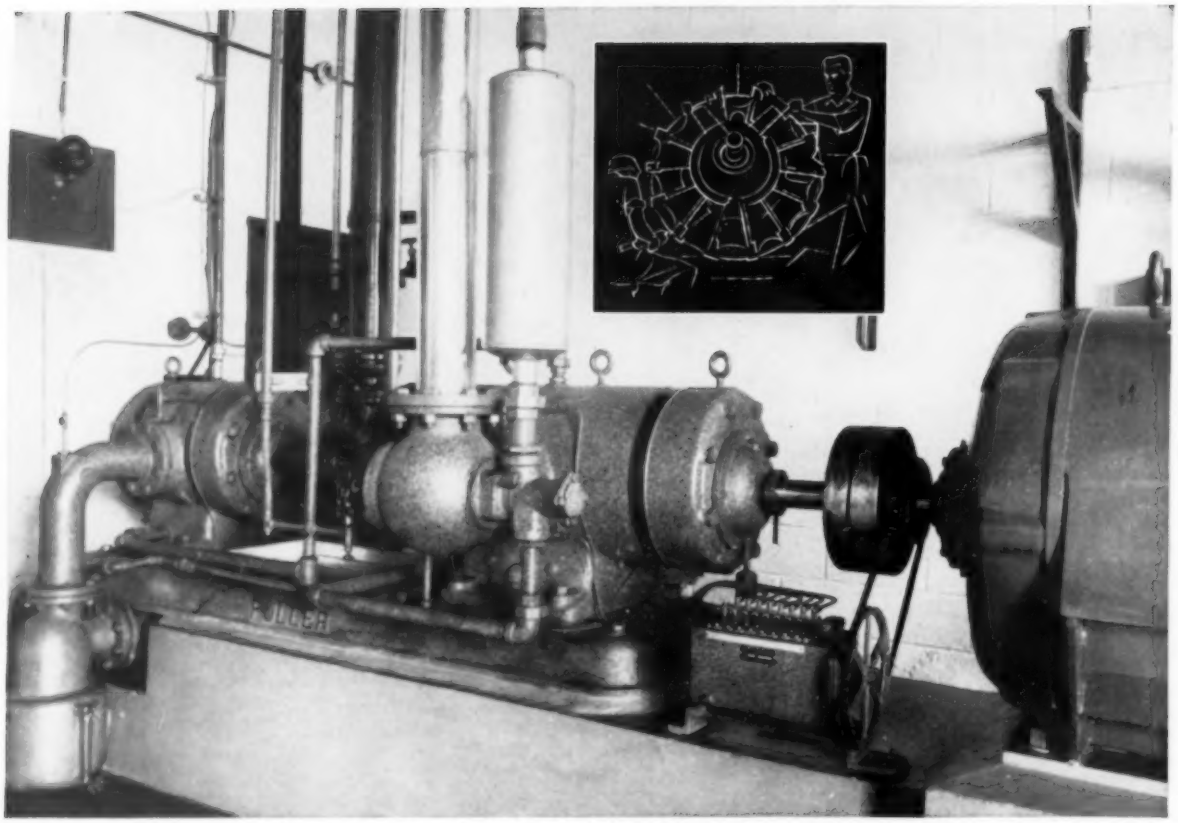

WHY DID AIRWORK SPECIFY A FULLER AIR COMPRESSOR?

Here's what the Vice President-Operations of Airwork Corporation, one of the nation's leading aircraft overhaul companies, writes about Fuller Model C-150-150H Rotary Air Compressors.

"We were running out of air capacity, and had decided that we would like to get rid of the maintenance problems inherent in a piston type air compressor.

"The Fuller compressor with its fewer moving parts and favorable price range met our basic requirements.

"We then checked on Fuller compressor performance through our close contacts with a leading manufacturer of aircraft engines. Their opinion was very favorable. We think Airwork has made the right decision."

Here are the features that sold Airwork on a Fuller Compressor:

- Wide seal between rotor and bottom of cylinder, assuring high volumetric efficiency.
- Rotary design assuring vibration-free flow of air.
- Direct drive.
- Compact space-saving installation.
- Simple foundation.
- No valves to leak or seats to grind.
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Circle **56** *on Time-Saver Card*

2. **Allow Enough Slack.** Hose lines shorten under pressure. Installation without enough slack can cause tensile stress on the hose when pressure is applied. This shortens hose life. Using the hose to pull something is even worse.

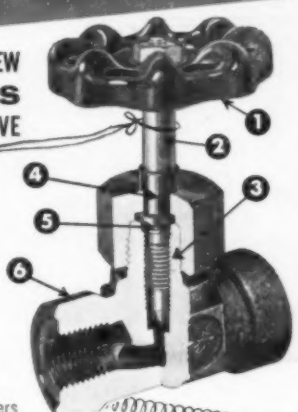
3. **Don't Twist It.** Hose should not be twisted when installed and the installation should be studied to see that there is no twisting when the parts connected by the hose move.

4. **Use Accumulators** to absorb surge pressures. Since hose expands with increased pressure it will absorb pressure surges. But these surges often exceed working pressure and shorten hose life. An accumulator should be used to absorb the surges. On mobile equipment, these surges may result from movement of pistons in cylinders as the vehicle bounces over rough ground. Hoses may burst when this happens. It's not the fault of the hose and may have saved a more expensive valve or cylinder. □□□

New 4-spiral and 6-spiral hose is almost as flexible as 2-wire braid. It requires only about 1 inch more on bend radius. Under test, spiral wrap, ⅜-in. hose burst at 55,000 psi.

THE INSIDE STORY

ON THIS VERSATILE, NEW 100 SERIES GENERAL PURPOSE VALVE



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5. GUARANTEED Leak-proof O-ring Seal
6. Rugged, Forged Carbon Steel Body in Globe or Angle Pattern

The new Series 100 line of full-flow, general purpose valves offers unusual features at a competitive price. Use for throttling, regulating, shut-off; over temperature range of —40 to 200°F. Male and female connections. Panel mounting, too. Send for FREE SAMPLE VALVE on your company letterhead.

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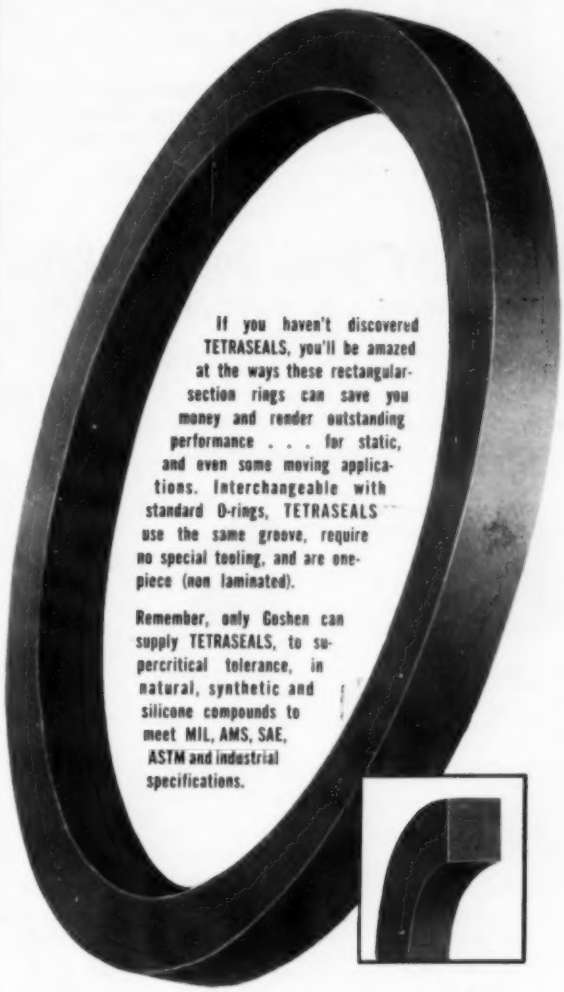

If you haven't discovered TETRASEALS, you'll be amazed at the ways these rectangular-section rings can save you money and render outstanding performance . . . for static, and even some moving applications. Interchangeable with standard O-rings, TETRASEALS use the same groove, require no special tooling, and are one-piece (non laminated).

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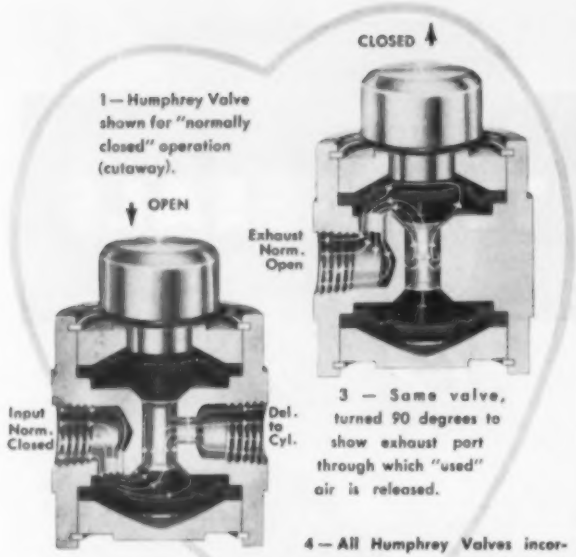
CLOSED
1—Humphrey Valve shown for "normally closed" operation (cutaway).
OPEN
Exhaust Norm. Open
Input Norm. Closed
Del. to Cyl.
3 — Same valve, turned 90 degrees to show exhaust port through which "used" air is released.
2—In "open" position—(palm button depressed) air flows freely through wide ports into cylinder.
4—All Humphrey Valves incorporate this same principle—with choice of valve body styles for:
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• Insert for manifold
• Manifold-mounted

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2-way and 3-way valves. Both one-coil "fail safe" and two-coil "momentary impulse" types.

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2-way and 3-way finger-tip operation. A touch opens or closes. Many models — lever, cam, foot pedal, palm button, etc.

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2-way and 3-way models, actuated by independent source of pressure. Two types: "fail safe" and "momentary impulse."

PILOT OPERATED VALVES

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Pneumatic-Hydraulic Valves and Devices

Circle **72** *on Time-Saver Card*

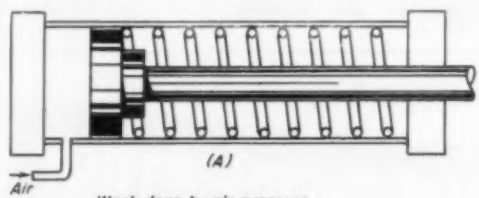
How to retract air cylinders

• BY ELMER F. HEISER,

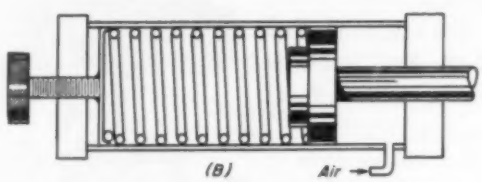
Precision Products, Inc., Cleveland, Ohio

SPRING-return cylinders as shown in sketch A have many advantages over those requiring air to move the piston both directions. Valves and piping are simple. A 3-way valve can operate the cylinder since air is connected to only one end. A small breather with a filter is used at the other end. When two cylinders are extended together, one 4-way valve can control both.

The air used is about half that of a double-acting cylinder. Often you can use a smaller compressor.



Work done by air pressure



Work done by spring force

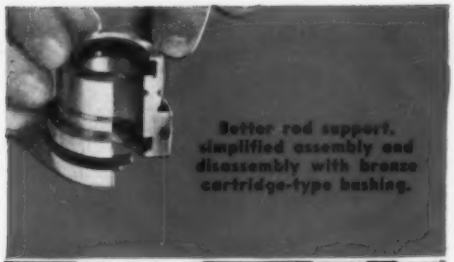
The spring return has an advantage on equipment which requires a fail-safe position in case of line pressure failure.

Sketch B, shows a simple, practical way to apply a light controlled spring pressure to do the work. Air is used for the return stroke. Spring can be adjusted to change the working pressure.

In most cases rod packing can be eliminated reducing friction and maintenance. The space where packing is omitted can be used as a bearing to increase life of the cylinder.

• **Limitations**—Stroke is limited by a reasonable spring working range. Also the installation must have

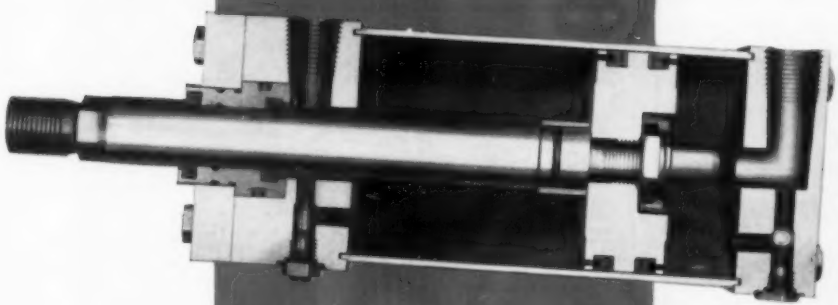
(*Continued on page 104*)



Better rod support, simplified assembly and disassembly with bronze cartridge-type bushing.

Pressure-sensitive barrel seals are radially supported, shoulders on barrel ends insure proper seal compression.

Other Hydro-Line quality features include: black oxide finish to protect ferrous surfaces and reduce friction; hardened and hard chrome-plated piston rods to resist nicking, abrasion, and corrosion; and more effective cushioning to reduce impacting.



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Economical use of quality materials coupled with sound basic design give you these advantages:

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3 Low maintenance costs.

4 Simplified installation.

You get all these qualities in a complete line of standard cylinders. Cylinders for more than 90% of applications are available for immediate shipment from factory stocks, permitting minimum cylinder inventories without jeopardizing production. Also, even on small orders Hydro-Line offers discounts on stock "R2" and "N" cylinders.

Only a few of the advantages of the new Hydro-Line Series R2 are shown. But — you can get more facts by filling in the coupon below or contacting the Hydro-Line sales engineer near you. Ask to see the Series R2 demonstrator for a close-up look at a truly efficient design.

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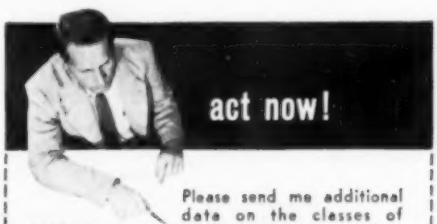

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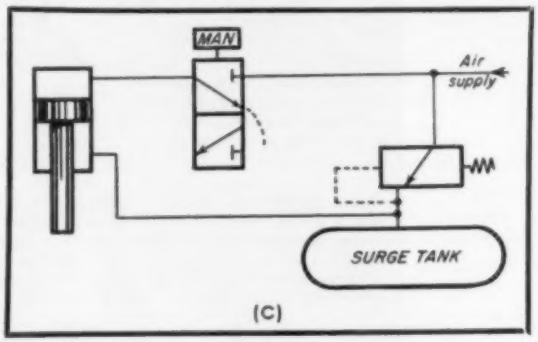
FLEXIBLE DRIVE COUPLINGS

PATENTS PENDING

HOW TO RETRACT AIR CYLINDERS

space for a cylinder four times as long overall than would be needed without the spring. Extra length is needed to give a reasonable ratio between the spring pre-load length and its working range to avoid over-stressing and fatigue failure.

Spring loading must be overcome on the work stroke and will subtract from the total effective cylinder force. Spring pressure should be low in relation to force needed for work stroke. Cushions can't be used on the spring end since it is open to atmosphere.



• **Use air for spring**—It's possible to get the advantage of a single-acting cylinder even if a spring-return won't fit. Use a large piston rod and float the rod end of the cylinder with air line pressure. In this case the effective work area is equal to the piston rod diameter. However if rod diameter is too large, friction may keep it from returning.

Reduced pressure can be piped to the rod end of a standard cylinder having a small rod diameter as shown in sketch C. A surge tank must be installed in the low-pressure line to prevent pressure build-up during the work stroke. The only air consumed in the rod end is make-up air to compensate for leakage. The work area must always overcome the return area and still do the work required of the cylinder. □□□

This article is prepared from a chapter in Elmer F. Heiser's book Air and Oil Cylinders in Industrial Applications, published by APPLIED HYDRAULICS & PNEUMATICS *magazine.*

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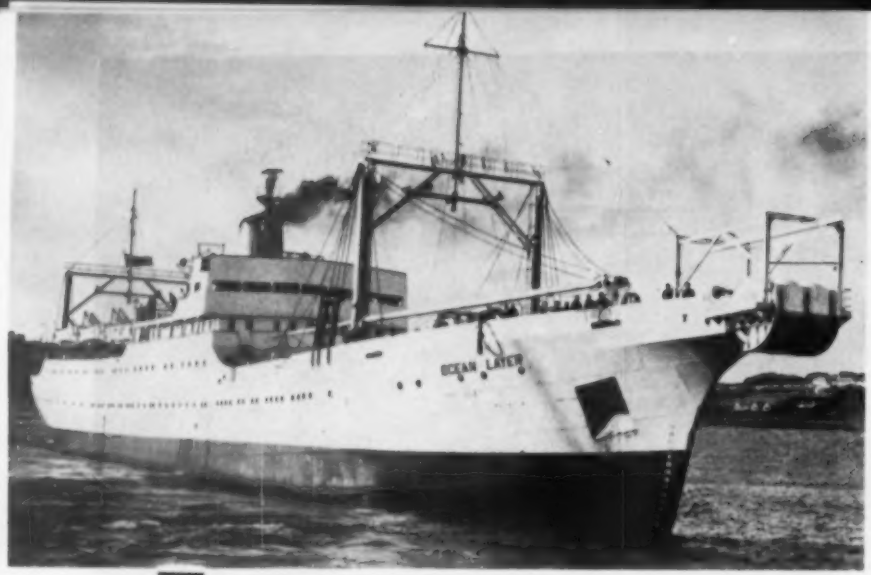
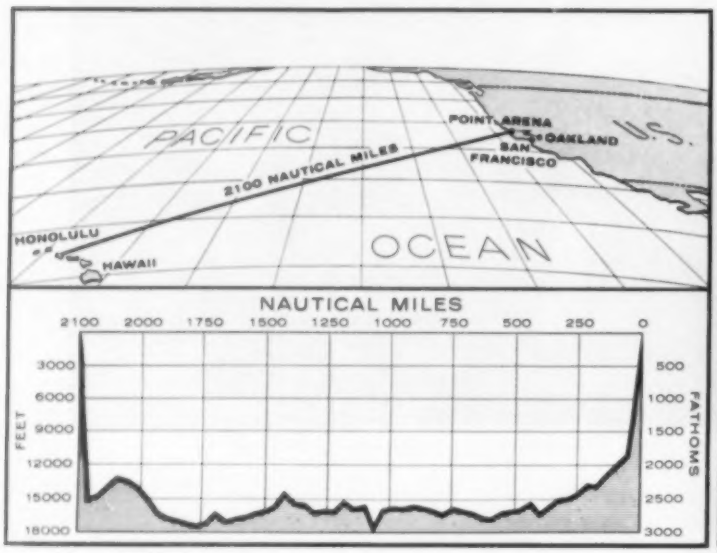
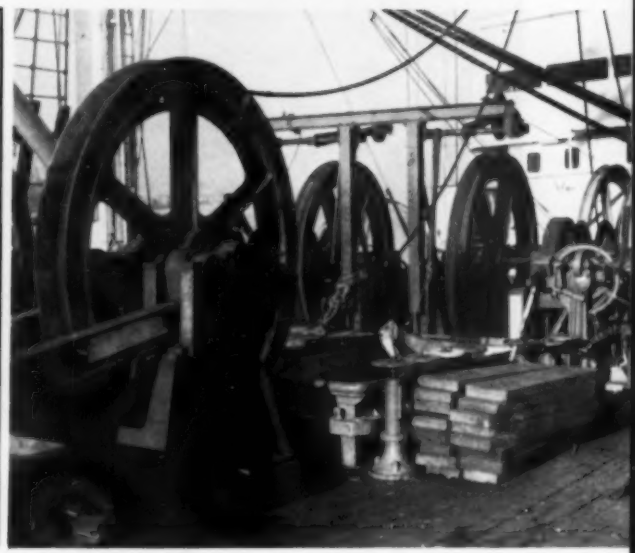


Hydraulic Ca Stops Cable

• By T. S. A. GREENWOOD and DEREK
Vickers-Armstrongs (Engineers) Ltd.,

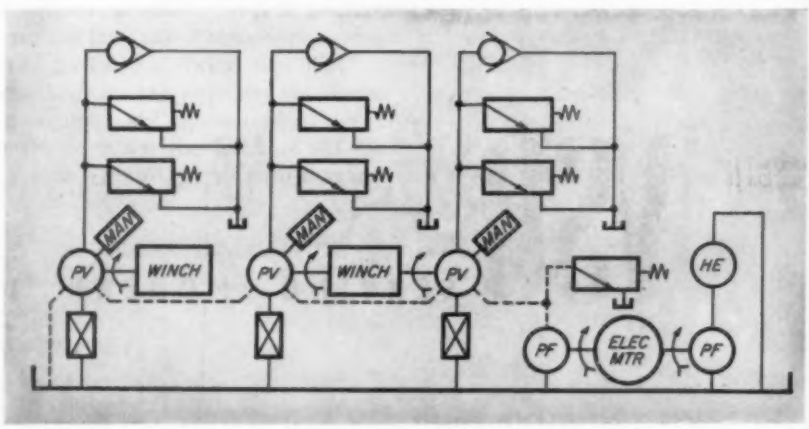
1 **Laying a submarine telephone cable across miles of ocean bed means that miles of cable must be unreeled from "tanks" in the hold of a cable ship like the *Ocean Layer* here.**





2 **Even though the bottom of the ocean is carefully surveyed to find the smoothest route, there are still many hills and valleys. Here's a chart showing the ocean bottom over the route between Point Arena and the Hawaiian island of Oahu. Steep slopes and underwater canyons which could destroy the cable are avoided. It still looks pretty jagged, though. Doesn't it?**

The cable is heavily armored to protect it. For about ten miles from shore, the main core which is about 5/8 in. diameter may be protected by enough armor to bring the OD of the complete cable to more than 3 in. This protects the cable from tide, marine life and shipping. Deepwater portion of the cable has an OD of 1.20 in.



ble Brake Breaks

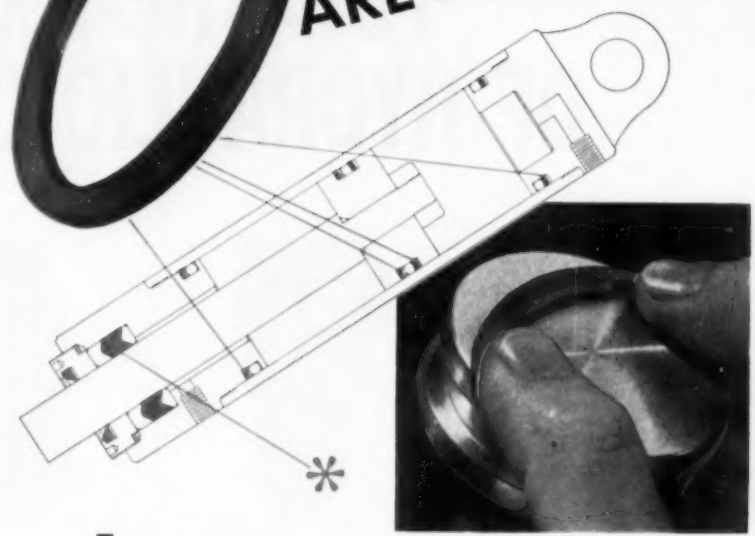
S. JACKSON, *Technical Liaison Officers. London, England*

3 Despite the carefully chosen route and the armoring of the cable, careful control of speed and tension is needed during laying. As the cable is drawn from the ship's hold by its own weight, it passes around two sheaves. One of these, the dynamometer sheave, measures the tension in the cable, while the other, the braking sheave, is braked to control this tension. Both Sheaves are about 9 ft, 6 in. in diameter. The dynamometer sheave is in the left foreground. Port and starboard braking sheaves are in the center.

4 Tension is controlled by driving hydraulic pumps with the winch sheaves. The pumps are manually-adjusted, variable-displacement types. By varying pump displacement, the amount of oil pumped through relief valves, and the tension in the cable is adjusted. Since all the oil is pumped through relief valves back to the 500-gallon tank, there's lots of heat generated. A small fixed-displacement pump continually circulates oil through a heat exchanger to control temperature. Another similar pump circulates oil through the housings of the braking pumps to keep them cool. Capacity of the port winch, which drives two pumps is 8 tons; capacity of the starboard winch, with one pump, is four tons.

Check valves in the pump outlet lines are there to protect the pumps in case they are accidentally shifted over center. This would reverse pumping direction were it not for the check valves, and the pumps could be emptied and damaged.

ALL O BACK-UP WASHERS ARE NOT ALIKE



This photograph shows Marsh No. 612 back-up washers being slipped into position. The washers s-t-r-e-t-c-h manually, or with production tooling, over pistons and SNAP BACK to original size. Allows quick installation of piston into cylinder without danger of pinching.

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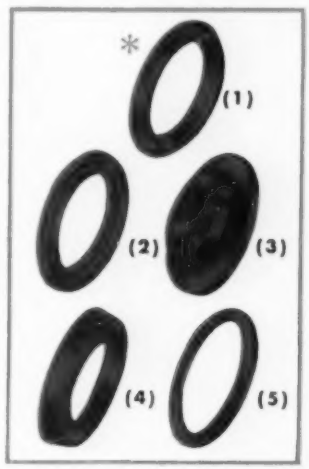

(1) VEE PACKING • (2) U PACKING • (3) FLANGE PACKING • (4) CUP PACKING • (5) NON-EXTRUSION or BACK-UP WASHERS

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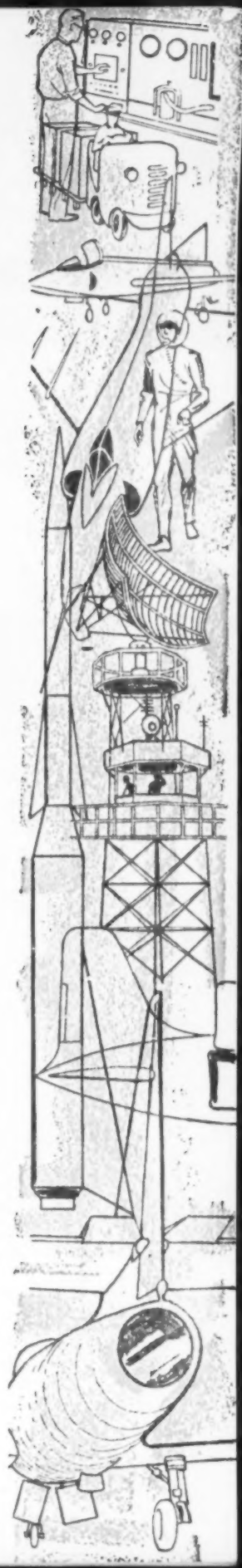

OPERATION OF AUTOPILOT SERVO ACTUATORS 110

By Richard K. Smyth

Explanation of basic aircraft autopilot systems — series, parallel, dual input, and combinations of these. Application factors such as frequency of stabilization or damping signals, complexity of system and components.

DESIGN OF LIQUID-SPRING SHOCK ABSORBERS FOR LANDING GEAR 114

By Edward Mucha

Three shock absorbers show how to design for greatest efficiency. Effects of fluid properties, temperature, orifice design are discussed.

AVIATION NEWS FROM THE FLUID POWER FIELD 118

AVIATION COMPONENT DATA 120

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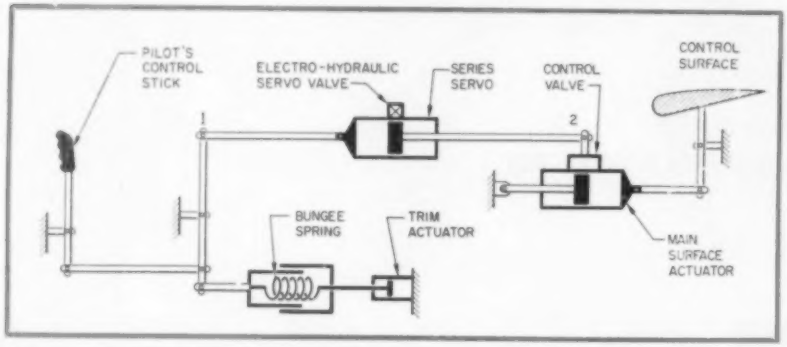
Operation of autopilot servo actuators

• By RICHARD K. SMYTH, *Senior Research Engineer, Autonetics, A Division of North American Aviation, Inc., Downey, Calif.*

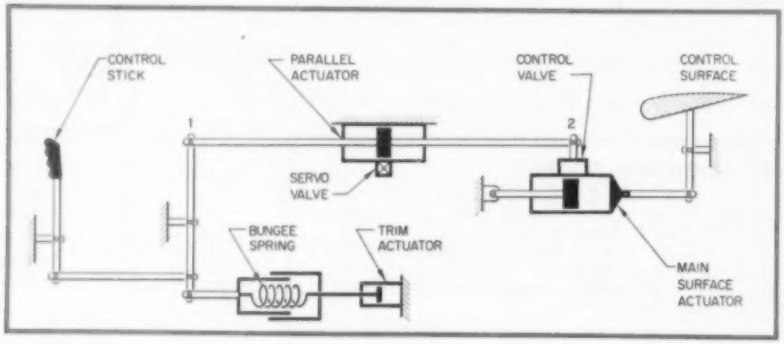
THREE types of hydraulic autopilot servos — series, parallel, and dual input — have been developed to keep aircraft stable at increased speeds. Typical instabilities are low aerodynamic damping at high altitudes and high Mach numbers, yaw and pitch divergence at high roll rates, trim gradient reversals, and low or negative static stability (e.g. tendency to go tail first).

Designers usually pick hydraulic power elements for autopilots because they give large power gain. They are less complicated, lighter, and have better torque-to-inertia ratio than electrical actuators with equal power capacity. The automatic control equipment's electronic computers have a very small power output, which is hydraulically amplified to operate the control surface against the huge hinge moments of supersonic flight. For example, a typical electronic computer output is 125 milliwatts. Peak power required to operate the control surface ranges between 6 kilowatts and 60 kilowatts depending on size and speed of the aircraft.

A series servo is arranged in the airplane mechanical control system, so that the servo moves the control surfaces but not the



SERIES SERVO — Electrical inputs to the servo valve change the length between points 1 and 2. This causes point 2 to move with respect to the airframe while point 1 remains essentially fixed, because very little force is required to move the control valve while considerable force is required to compress the bungee spring. Opening the control valve allows high pressure oil to go to the surface actuator causing it to move until the motion at point 2 is followed up, and the control valve is again closed.



PARALLEL SERVO — The body of the parallel servo is fixed to the airframe. Any electrical input to the servo valve moves points 1 and 2 together. As a result, the control stick is deflected and the control valve is opened in proportion to the parallel servo extenison.

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pilot's stick. The series servo is usually used for damping signals.

Parallel servo movement also moves the pilot's control stick. The parallel servo is usually used for outer loop control signals such as Mach, altitude, or pitch attitude.

• **Application of Series and Parallel Servos** — The series servo is usually preferred for high frequency stabilization or damping signals. The series servo isolates the stick from the damping signals. It prevents stick jitters and random stick motions that irritate the pilot and possibly interfere with his normal control of the airplane. For safety, the control authority of the series servo is usually limited to 1 or 2 degrees of control surface motion (of a possible 25 to 30 degrees). This usually damps enough, without damage to the aircraft from sudden, hardover servo deflection due to electronic or hydraulic malfunction.

The parallel servo is normally used for supervisory control signals such as pitch attitude or Mach Number, whose signal frequencies are relatively low. The control stick motions resulting from these signals are slow, not likely to bother the pilot. The parallel servo is normally given complete authority which is about 25 to 30 degrees of surface deflection. Although hydraulic or electronic malfunction is still possible, the pilot immediately senses the trouble through motion of the control stick. The pilot may easily override the action of the parallel servo by applying the design override force of abut 25 pounds.

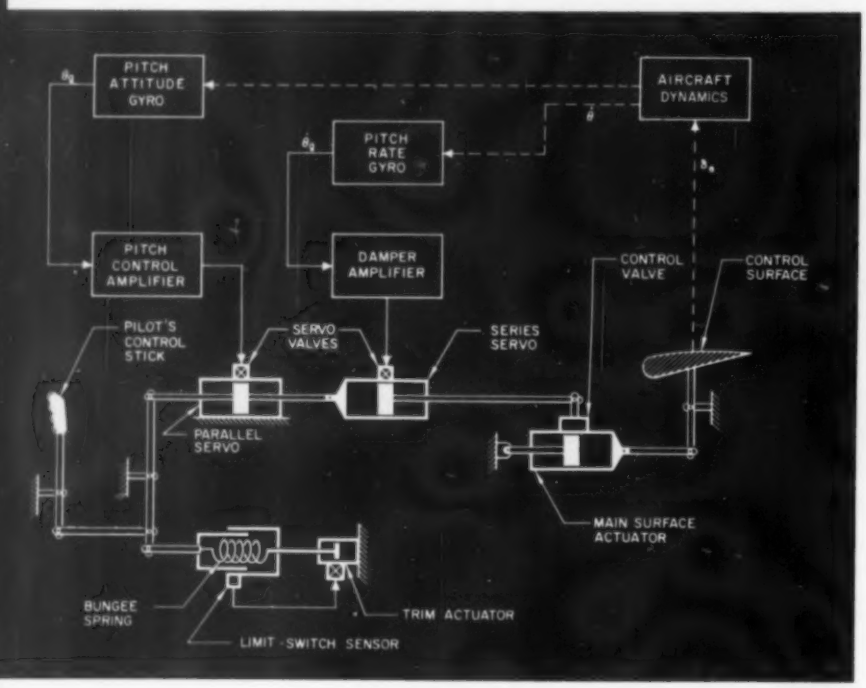
Some control systems have full authority series servos. These systems fail safe by using dual electronics, dual series actuators, and a monitor that automatically cuts off the autopilot, recenters, and locks the servos in case one of the two channels malfunctions. One of these systems was used in North American's F-107.

• **Which System?** — The autopilot designer can not always specify the complete mechanical control system. For example, an autopilot may be required in an aircraft already equipped with a conventional control-valve, surface actuator configuration. Then it is usually simpler to install a series-plus-parallel servo combination than to replace the control-valve, surface actuator with a dual input servo described in the diagram on the opposite page.

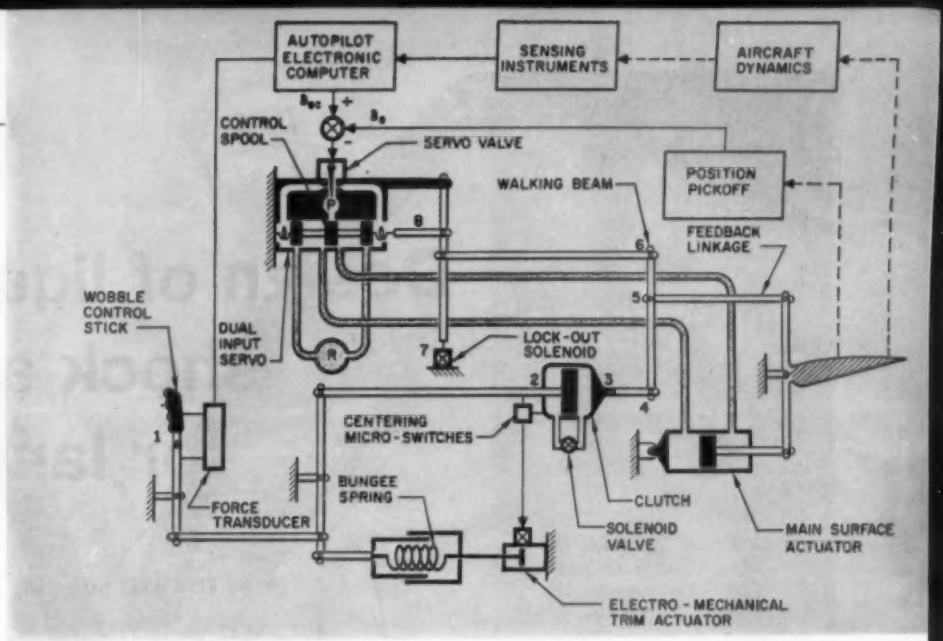
Hydraulic vs. Electrical Autopilots

. . . hydraulic actuators are usually selected for autopilots because of their high power gain. They have better torque-to-inertia ratio than electrical actuators with equal power capacity.

The use of a dual input servo leads to a simpler system, but uses more complex components. A series-plus-parallel servo means a more complex system, but simpler components. When the designer can specify the complete mechanical control system, he may decide to use a more complicated system in favor of simpler components. □□□



SERIES-PLUS-PARALLEL SERVO — —Damping signals are fed to the limited authority, series servo which produces control surface deflections for damping, but does not cause control stick jitter. The supervisory control signal (pitch attitude in this case) is fed to the full authority, parallel servo which moves the control surface to obtain the desired pitch attitude and simultaneously causes the control stick to follow these relatively slow surface motions. A refinement to the system provides a signal from a limit switch sensor to the trim actuator to relieve any compression of a bungee spring due to parallel servo deflection. This prevents the bungee spring from snapping to neutral and causing a sudden surface deflection when the system is cut off.



DUAL INPUT SERVO—Functions of the main actuator control valve, electrohydraulic servo valve, series servo, and/or the parallel servo are combined in a package. Several modes of operation are possible, although for a specific system, probably only two or three of these modes would be used.

Manual mode is obtained by closing the solenoid valve to make the clutch a solid link; retracting the lock-out solenoid at point 7; and deactivating the servo valve.

A backward movement of the stick rotates the walking beam clockwise about point 5. Resulting motion at point 8 moves the control spool to the right, allowing oil to flow to the main actuator. Surface motion transmitted through the feedback linkage rotates the walking beam counterclockwise about point 4 and centers the control spool. Because of bungee-spring compression the pilot feels a stick force proportional to the deflection.

The control spool and springs are attached to a carriage (not shown in detail). The carriage is free to move relative to the servo case. A movement of point 8 moves the carriage and the control spool, but does not compress the springs. Thus very little input force is required to move the control spool for mechanical inputs.

Damper mode is obtained from the manual mode by activating the servo valve. Action for a control stick input is the same as in manual mode. However, the control spool may now be moved by an electrical input to the servo valve as a result of damping signal from the electronic computer. If the electrical signal moves the flapper arm to the left, pressure on the right end of the spool decreases. Pressure differential moves the control spool to the right relative to the servo case and carriage, until the end springs balance the pressure force. Oil is then ported to the main actuator. As the control surface moves, the feedback linkage centers the control spool.

Control surface deflection is proportional to the sum of the pilot's mechanical input and the damper system's electrical input. Because the control stick does not move with the electrical input signals during the damper mode, the servo can be considered a series system.

Conventional autopilot mode (no stick) is obtained from the damper mode by operating the lock-out solenoid, so that point 7 is held fixed, and feeding back surface position with an electrical position pickoff. During this mode the pilot does not normally move the stick, except to override by overcoming lock-out solenoid force.

An electrical surface command is compared with the existing surface position, and the resulting error signal is applied to the servo valve. The control spool then shifts to port oil to the main actuator. The surface moves until the surface feedback signal balances the command signal re-centering the control spool. When the surface moves, the feedback linkage rotates the walking beam about point 6 (point 7 is fixed). Motion of the walking beam is reflected at the stick, which moves in proportion to surface deflection. Since the control stick follows the electrical input signals, we have a parallel servo during this mode.

When the pilot applies an override force, the configuration returns to the damper mode momentarily. As with a regular parallel servo autopilot, compression on the bungee spring must be relieved so that snapback will not cause a sudden surface deflection. Here two center-sensing limit switches operate the trim actuator motor until the bungee spring is neutral.

Stick-steering autopilot mode uses the same system as the conventional autopilot, except that the solenoid valve on the clutch is open, and point 2 moves independently of point 3, as long as the clutch is not bottomed. During this mode, the pilot controls the airplane without overriding the autopilot.

If the pilot pulls back on the stick, an electrical signal from the force transducer is sent to the electronic computer. The computer compares this signal with the desired aerodynamic response of pitch rate or normal acceleration and computes the proper surface deflection. As a result of the mechanical stick motion, point 2 moves to the left. As a result of surface movement commanded by electrical signal, point 3 also moves to the left. Thus the clutch remains essentially centered. When the pilot pulls back on the stick, he feels only the compression force of the bungee spring.

The autopilot electrical signals may command surface deflections for damping and control independent of the pilot's control stick inputs. A surface deflection due to electrical input may move point 3 to the right, while point 2 remains fixed. Therefore the clutch tends to become un-centered. A pair of limit switches mounted on the clutch then operate the trim motor to re-center the clutch. The trim actuator rate is low enough so that it responds only to relatively long-period changes in the surface position. This eliminates any high frequency jitter at the control stick due to high frequency damping signals. However, if the autopilot malfunctions so that the surface is commanded to move a large distance rapidly, the clutch bottoms, moving the stick to warn the pilot before structural damage occurs.

The dual input servo in this mode has the characteristics of a series servo for small surface movements which might result from damping signals, but operates as a parallel servo for long period changes or large, rapid movements.

Design of liquid-spring shock absorbers for landing gear

• By EDWARD MUCHA, *Avro Aircraft Ltd. Toronto, Canada.*

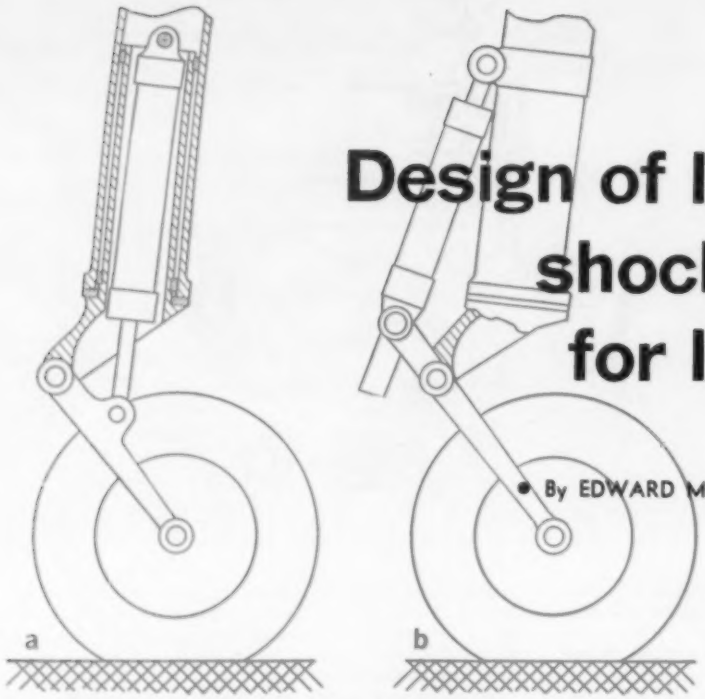


FIG. 1. LARGE AXLE TRAVEL gives small shock absorber travel with these two suspension designs. This almost pure spring effect, combined with tire stiffness, smooths down the rough ride of the tire. In (b) the shock absorber works in tension.

A PROPERLY designed hydraulic landing gear absorbs a large amount of energy; fits limited space in today's thin wings and fuselage; and provides smooth taxiing with the 250-psi tires now in use. A complete design requires the prediction of dynamic landing loads, derivation of spring curves, and a calculation of damping and recoil orifices.

This article shows three basic designs and emphasizes the hydraulic considerations for proper operation.

• **Ground Reaction Force**—Landing attitude, sinking speed, aircraft weight, and amount of wing lift determine the ground reaction factor. This factor is the ratio of the vertical component of the total ground reaction to the vertical component of the static reaction. Table I gives a rough guide for different aircraft.

Except for the points at which the landing gear is attached, and a rib to withstand the concentrated load from the landing gear, design of the wing or fuselage should not be affected by ground reaction forces.

• **Efficiencies**—The ratio of energy absorbed by the shock absorber to the maximum vertical component of ground reaction times vertical axle travel gives overall efficiency of the shock absorber. Efficiencies of liquid spring shock absorbers, Figures 2, 3, and 4, vary from 80 to 95%. The higher the efficiency, the smaller is the vertical reaction for a given vertical axle travel.

Obviously, a design of a shock absorber for landing gear can not be divorced from the design of the whole aircraft. For example, usually on a delta or swept-back wing aircraft, the shock absorber is a part of a long flexible undercarriage strut on a flexible wing. The strut is far from the center-line of the aircraft and some distance from the flexural axis of the wing.

TABLE I
GUIDE TO GROUND REACTION FACTORS

Factor	*Aircraft*
1.5—2.0	heavy transport, passenger, bomber
2.0—3.0	light bomber
2.5—3.5	fighter
3.5 up	naval aircraft landing on carriers

TABLE II
FACTORS AFFECTING SHOCK ABSORBER PERFORMANCE

1. Type of fluid
2. Initial fluid pressure
3. Compression ratio
4. Geometry of wheel suspension
5. Type of orifice
6. Temperature

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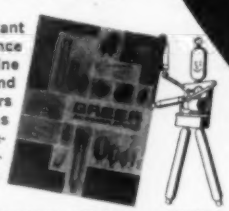

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On these planes it may be best to design the shock absorber with low efficiency, increasing its travel to absorb the required energy. This cuts down dynamic magnification factors for spin up and spring back and decreases weight of the undercarriage and fittings on the wing.

When the shock absorber is a part of a short, rigid undercarriage strut mounted on a rigid wing near the center-line of the aircraft, a high efficiency shock absorber is desirable.

Table II lists the factors which influence the characteristics of a liquid-spring shock absorber.

• **Fluid**—A liquid-spring shock absorber should use a fluid having: a freezing point below —80 C; a flash point above 250 C; adequate lubricating qualities; good stability at high pressures (working pressure of liquid-spring shock absorbers is up to 50,000 psi); freedom from toxicity.

Silicate-base fluids meet these requirements. Each fluid has a different compressibility curve which has to be known when designing a shock absorber.

When the shock absorber is fully extended, the initial pressure of the fluid must be at least 300 psi. Without this minimum pressure there is no spring at the start of closure, operation is spongy. Most shock absorbers have an initial pressure from 1,000 to 2,000 psi.

• **Spring Curve**—Shape of the spring curve depends on compression ratio of the fluid (rod end piston area times travel over initial fluid volume), and geometry of the wheel suspension.

Geometry of the wheel suspension gives the mechanical advantage which is taken as a ratio of closing load to shock absorber load. The vertical component of the ground reaction at the axle which is balanced by the shock absorber load is called the *closing*

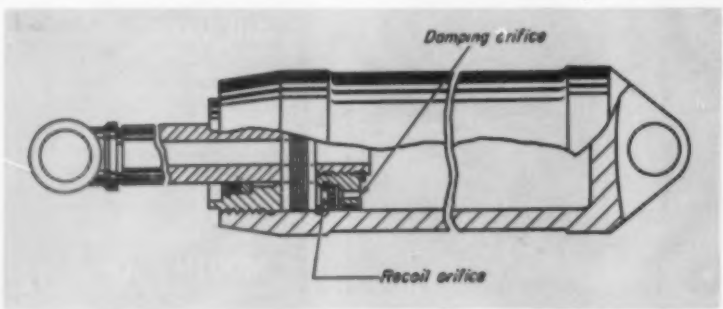


FIG. 2. CONSTANT ORIFICE type liquid-spring shock absorber is the simplest, lightest, most compact, and most reliable for aircraft with tire pressures around 100 psi and operating in a narrow temperature range. Efficiency is about 80%.

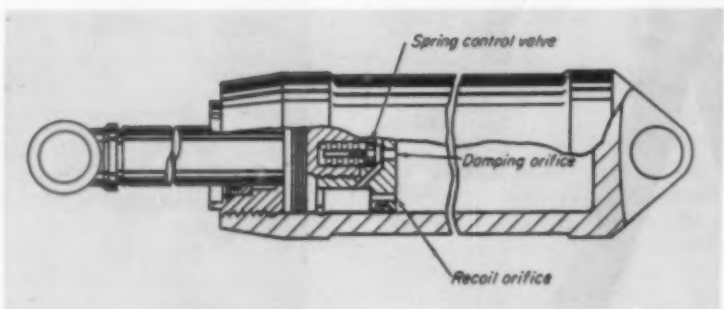


FIG. 3. SPRING CONTROL VALVE shock absorber is best for naval aircraft, especially for nose undercarriages. Until the control valve spring is compressed by fluid pressure below the piston, the fluid from the piston passes only through the small recoil orifice, and the dashpot load grows rapidly. This is very useful for aircraft landing on an aircraft carrier because it prevents an excessive pitching set up by the load developed by the arrester hook and ground reaction of the main undercarriage. Once the spring control valve opens, the vertical component of ground reaction becomes almost constant giving 85 to 90% efficiency.

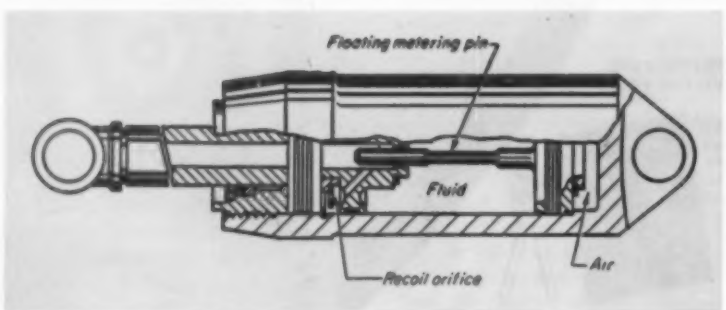
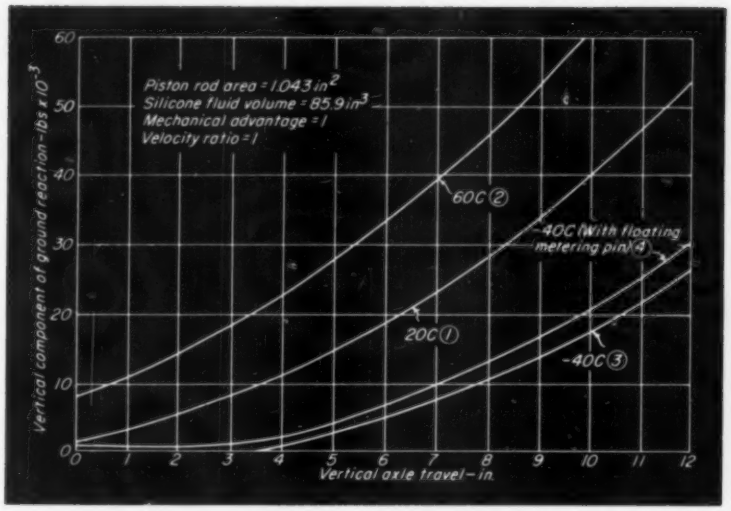


FIG. 4. FLOATING METERING PIN design is for modern, high speed aircraft with high tire pressures, operating in wide temperature range and in any conditions encountered during taxiing, take-off, and landing. Efficiency approaches 95%.


Piston rod area = 1.043 in²
Silicone fluid volume = 85.9 in³
Mechanical advantage = 1
Velocity ratio = 1
60C ②
-40C (With floating metering pin) ④
20C ①
-40C ③
Vertical component of ground reaction - lbs x 10⁻³
Vertical axle travel - in.

load of the shock absorber. Closing load plotted against vertical axle travel gives the spring curve for shock absorber.

Slope of the spring curve determines passenger comfort during taxiing and take-off. If the spring curve is too steep, he feels the smallest bump. It is too flat, the aircraft bounces. To make the spring curve steeper for the given wheel suspension and shock absorber travel, piston rod area is increased or fluid volume is decreased. Geometry of the wheel suspension also influences slope of the spring curve and riding qualities of the undercarriage.

The vertical component of ground reaction for a given shock absorber and wheel suspension geometry is balanced by the spring curve and dashpot of the shock absorber. Dashpot action is caused by resistance of the fluid to pass through the orifices. The size of the dashpot load for given conditions can be varied by the size and shape of the damping orifices. Figures 2, 3, and 4 show shock absorbers with three different orifice designs.

• **Temperature Effects**—If a liquid-spring shock absorber is filled with silicone fluid at room temperature (20 C), and during the operation of the aircraft the temperature drops to —40 C, the silicone fluid contracts to about 0.948 of its original volume. The piston rod is drawn in, taking the space of the contracted fluid, and there is a loss of shock absorber travel. If the temperature of the fluid increases to 60 C, the silicone fluid expands to about 1.035 times its original volume. This expansion raises fluid pressure. Figure 5 shows spring curves at three different temperatures. Loss of shock absorber travel at —40 C is 3.57 inches. To counteract this loss, a floating metering pin shock absorber, Figure 4, is used. At 20 C the floating pin just touches the head end stop, the fluid pressure and air pressure are in balance. When temperature drops to —40 C the fluid contracts, but the air pushes the floating pin taking the space of the contracted fluid, and there is no loss of shock absorber travel. The dashpot load can be also compensated by proper shaping of the metering pin.

Spring curve (4) in Figure 5 is drawn for a floating pin shock absorber having the same piston-rod area, initial fluid volume, travel, and pressurization as the shock absorber for which the curves 1, 2, and 3 are shown. The spring curve, 1, is exactly the same for both shock absorbers; the spring curve 2 is slightly higher for the floating pin liquid spring shock absorber due to additional pressurization of the fluid caused by increase of pressure of the air due to increase of temperature. □□□

CERTIFIED SEALING REPORT NO. 6740

from the Research and Development Laboratories of Plastic and Rubber Products Company, 2100 Hyde Park Boulevard, Los Angeles 47, California. Telephone: AXminster 5-4331

DESIGN PIONEERS PICK PARCO O-RINGS

Hydraulic Research and Manufacturing Company pioneered the first electro-hydraulic servo valve to combine precision hydraulic design and operation with dependable dry coil construction without sacrificing performance. Like so many manufacturers of guidance system components, H-R looks to Parco engineers for the advanced rubber technology that makes Parco O-Rings mean reliability... for aircraft / missile or ground applications with the most critical temperature-pressure requirements.

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Plastic and Rubber Products Company
2100 Hyde Park Boulevard
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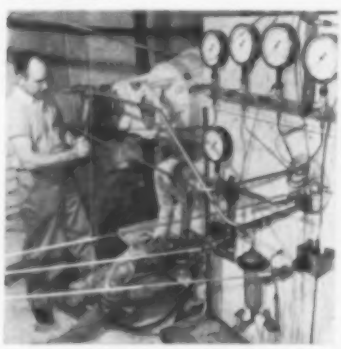
Circle **114** on Time-Saver Card

AVIATION NEWS

from the fluid power field

Weston Hydraulics, Ltd., North Hollywood, Calif., a subsidiary of Borg-Warner Corp., announced three management changes. **I. E. Weston** promoted from president to chairman of the board; **Fred O. Hosterman** from executive vice president to president; and **A. E. Shumante** made executive vice president and assistant general manager.

HOT BOX . . .



. . . installed in *Chance Vought Aircraft's* new high-temperature fluid test laboratory cell. This box, made of asbestos cement sheeting, contains a hydraulic system in which new type hydraulic fluid is being tested under high pressure and temperature. Dials at the top register pressure and lower rods permit remote control of fluid flow and hot and cold air.

The Weatherhead Co. has appointed **John W. Wolcott III,** sales manager for the Special Products Division of the new Aviation and Missile Group in Cleveland. Wolcott will coordinate sales of ordnance, aviation and missile products.

NEW FRENCH TEXT . . .

. . . Though it will take all your high school French to read it, there are many design ideas just in the illustrations of a book written by Jacques Faisandier, Technical Manager of Societe D'Applications Des Machines Motrices.

Developed from a course on hydraulics taught by the author, *Les Mechanismes Hydrauliques* is a thorough treatment of hydraulic theory, components, and systems for aircraft.

The section on general principles develops equations of mechanics, viscosity, compressibility, and discusses aniline point, and fluids. The section on pumps explains representative types with detailed mathematics. Actuator installations and packing designs are shown and various servo valves including electro-hydraulic are analyzed in addition to basic types. Filters, shaft sealing, and plumbing techniques are part of the section on components. The final pages are devoted to studies of specific aircraft systems, and a comparison of hydraulic and pneumatic systems for aircraft.

John W. Overbeke, chief consultant hydraulic engineer for Convair Division of General Dynamics Corp., San Diego, Calif., recently died of a heart attack.

Overbeke was well known in the fluid power field and held many patents. He had also written articles and technical papers in the field of aircraft hydraulics.

Dr. William O'Donnell, chief engineer for aircraft and missile development at **Republic Aviation Corp.,** said his group was ending a 1½-year research program on hydraulic systems for temperatures from 20 to 1000 F. Systems were developed to withstand 1000 F but the same systems do not function below freezing.

Bell Aircraft Corp. has developed an electronic device which automatically tests the electrical, hydraulic, and pneumatic systems of missiles and airplanes in a fraction of the time normally required. The device is compact and combines high-speed, accuracy, and reliability.

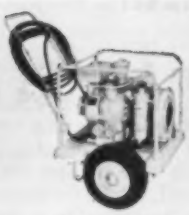
Greer Hydraulics, Inc., has appointed **A. E. Ulmann & Assoc., Ltd.,** New York City, as exclusive representatives for sales in Europe, Mediterranean and Near East countries.

Merger of **Wyle Laboratories** and **Wyle Research Corp.,** both of El Segundo, Calif., has been announced by Frank S. Wyle, president of Wyle Laboratories, the continuing corporation. This makes Wyle Laboratories the country's largest missile and aircraft components testing firm.

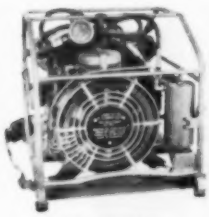
Consolidated Diesel Electric Corp., Stamford, Conn., named **John J. Marick** senior project engineer. He will be responsible for the design of hydraulic, pneumatic, and mechanical test systems. Marick has had seven years experience as a design engineer with major hydraulic and mechanical equipment manufacturers.

TRUE PORTABILITY

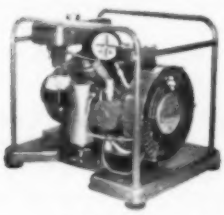
is why one man can service aircraft or missiles in minutes with Cornelius ground support air compressors



Model 3790109
7 SCFM — 150 psi

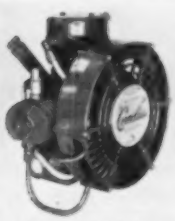


Model 3260101
3.5 SCFM — 2000 psi

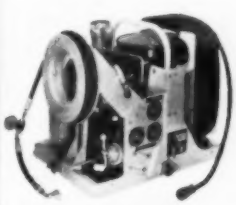


Model 3750303
3.5 SCFM — 3000 psi

Model 130R1409
2 SCFM — 3000 psi



Model 3800100
4 SCFM — 3000 psi



Model 130R3500
2 SCFM — 3000 psi

Cornelius ground support air compressors are light enough to be handled by one man but don't let their small size deceive you! When it comes to performance they provide pressures up to 3000 psi and air delivery up to 4 SCFM. Cornelius compressors can often be wheeled into service and complete jobs faster and easier than motorized equipment. They are ideal for "retriever" service because they are easily and economically flown to stranded aircraft.

A complete Cornelius ground support service system includes compressor, moisture separator, oil filter, inlet filter, relief valve, pressure gauge and high pressure hose. Pressure reservoirs, back pressure valve, pressure regulators and chemical driers are optional. Gasoline engine drive, hydraulic or electric motor drive as well as turbine drive can be used to power Cornelius equipment. All U. S. military services use Cornelius compressors. Aircraft, missile, flame thrower and underwater demolition support are a few of their current applications.

Cornelius also manufactures compressors only, for mounting on your own multi-purpose ground support carts. In addition, a complete line of small industrial compressors (up to 3000 psi discharge pressure) for OEM, lab work, production test work and maintenance are available.

For true portability, one man operation and reliability in a small, compact, *low cost* ground support compressor, talk with a Cornelius sales engineer or write today for more information.

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AERO DIVISION

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Pioneers in pneumatic systems for aircraft.

Circle **2** on Time-Saver Card

Fall Wiper Ring SPRING LOADED

The Fall "CJ"* Wiper-Scraper Ring is Spring-Loaded causing Squeeze-Grip Action on the O.D. of the piston rod during entire cycle. This patented feature maintains a uniform, continuous pressure on the wiping edge of the ring at all times, stopping any buildup of foreign matter between the ring and the rod.

It automatically takes up wear, maintaining NEW RING PERFORMANCE. Available in diameters ½" through 13" for any commercial use. AN and MS numbers in use by the Military and Aviation industry since 1944. Manufactured in accordance with MIL-S-5049. (*Closed Joint)

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Miniaturized **bourdon helix** gauges, pioneered by Glassco Instrument Company, have only one moving part. No gears, no linkage, they offer exceptional performance and reliability with minimum space and weight, plus design flexibility to meet unusual specifications.

For details, write for Bulletin G-1005

Glassco

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Circle **59** on Time-Saver Card

AVIATION COMPONENT DATA

Hydraulic Pump/Motor . . . runs at 24,000 rpm

Called the Hummingbird, this miniature hydraulic pump/motor delivers 2.5 gpm at 3000 psi. It runs 50 hours at 24,000 rpm with

no efficiency drop. Metallic O-rings and seals allow operation of the units from −65 to 550 F. Weight 1.1 lbs. Used as a pump for auxiliary power, and as a motor for driving an alternator.—*Pesco Products Division, Borg-Warner Corp., Bedford, Ohio.*

Circle **500** on Time-Saver Card

Four-way Valve . . . weighs 0.66 lb

The MC2660 is a three-position, manually-operated, 4-way valve for

600-psi air. Temperature range is −65 to 160 F with intermittent exposure to 260 F. Handle torque is 20 lb-in. at rated pressure. Port connections for ¼-in. tubing. Also made with different lever combinations for airborne or ground use.—*M. C. Mfg. Co., Lake Orion, Mich.*

Circle **501** on Time-Saver Card

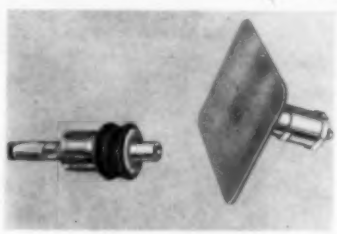
Design Booklet . . . on silicones

SILICONES IN MISSILE DESIGN is an 8-page booklet covering the many uses of silicones for miniaturization and weight reduction to increase the reliability of missiles. Incorporating of silicones in hydraulic fluids to increase heat stability is one of the uses outlined.—*Dow Corning Corp., Midland, Mich.*

Circle **502** on Time-Saver Card

Quick Disconnect Couplings . . . are flush-mounted

Made in sizes ¼ to 2 in. with operating pressures to 4000 psi.



Temperature range −65 to 320 F. Engaged by inserting the ground unit into the airborne section until it reaches a stop point, then rotating 90 degrees. Visual indication and audible click tells when connection is made. A pressure lock holds collar in locked position above 100 psi line pressure.—*Airaterra, Glendale, Calif.*

Circle **503** on Time-Saver Card

Static Seal . . . stands 1200 F

Designed for aircraft, missiles and test stand installations. Seal deforms when torque is applied and

Continued on page 122

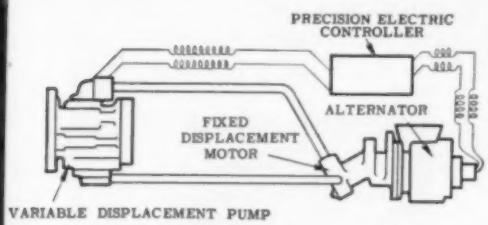
Circle **144** ➡

New VICKERS **building block** concept applied to

CONSTANT SPEED DRIVES

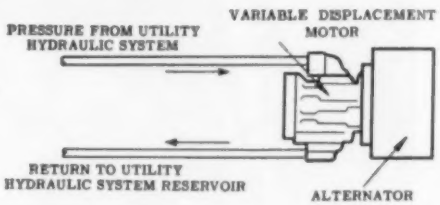
for 400 cycle A.C. electrical systems

1. Unlimited Versatility
2. High Efficiency
3. Fast Delivery
4. Low Cost



Frequency control ± 0.1%. Uses electronic frequency controller to regulate pump displacement. System pressure is function of load.

Frequency control ±0.25%. Uses load sensitive system to match infinitely variable electrical load. System pressure is constant, flow demand is load dependent.



- Using this "building block" construction, Vickers Constant Speed Drives are assembled to exact requirements from the abundance of Vickers standard and proven components. Practically any characteristics you need can be quickly adapted to the existing Vickers product mix. These include:

FREQUENCY CONTROL

± 3% with hydraulic control
± 0.1% with electronic control (or better if desired)

VERSATILITY

1 to 75 hp with standard hardware
Flexibility of package shape and location

HIGH EFFICIENCY

Volumetric efficiency of either pumps or hydraulic motors is 96% at 3000 psi. This together with optimum matching of components results in very high system overall efficiency.

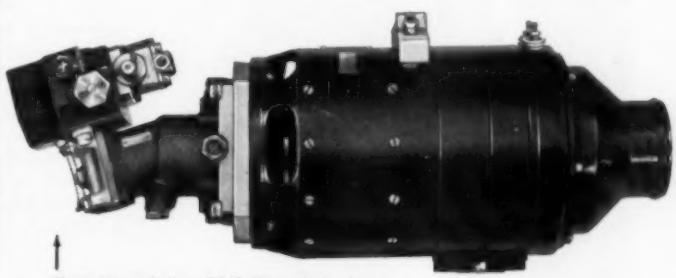
MINIMUM WEIGHT

Significant optimization engineering can be applied to your system design considerations from similar Vickers application experience.

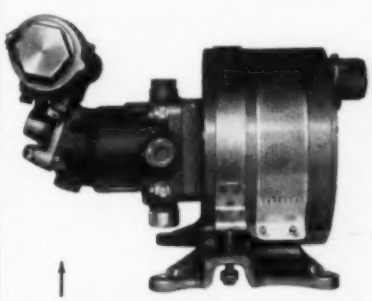
OVERLOAD CAPACITY

Depending upon system requirements, overload capacity of from 120% to 200% can be provided.

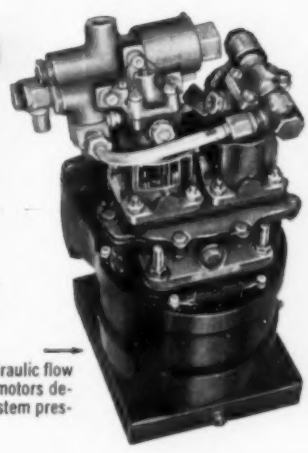
For further information, write for Bulletin A-5234



Frequency control ± 0.1%. Uses electronic frequency signal to trim hydraulic flow control. System pressure is constant.



Frequency control ± 3%. Uses hydraulic flow control only. System pressure is constant.



Frequency control ± 3%. Uses hydraulic flow control to supply single or dual motors depending upon load variations. System pressure is constant.

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Small size: Eastern gear pumps are the smallest, lightest made. Airborne servo system pump shown delivers 1.5 gpm @ 1500 psig — measures only 1⅞" x 1⅞" x 2¾", weighs 9 oz.

Wide performance range: pumps available have theoretical displacement from .0016 to .0419 cu. in. per revolution — flow from .025 to 2.0 gpm, pressures from 0 to 2000 psig, at speeds to 24,000 rpm. Weights with motor range from 1.5 to 8.5 lbs.

Unaffected by extreme environments: rugged, reliable Eastern units take loads to 50g in stride — shrug off temperature differentials to meet MIL specs.

Flexibility, economy: mass-produced components can be teamed into the precise configuration you need. Creatively-engineered custom pumps also available.

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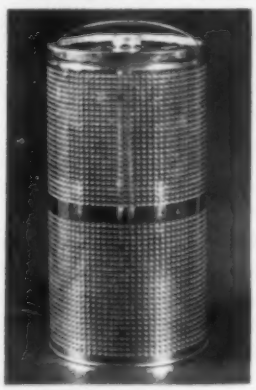
AVIATION COMPONENT DATA

crimps to the neck of fittings, giving a leak-proof seal even if the fitting has a rough finish. Made in anodized aluminum, stainless steel, or Inconel-X, the seal has been tested in hydraulic systems at temperatures from —320 F to 1200 F and pressures over 10,000 psi.— *Navan Products Inc., Los Angeles, Calif.*

Circle **504** on Time-Saver Card

Cellulose Filter Pack . . . has high particle retention

Removes particles to practically zero microns with 99.9 percent ef-



fectiveness. Used on test stands with MIL-H-5606A oil. Holds 100 to 150 grams of contamination. Will not remove additives. Improves performance of oils. — *Luber-finer Inc., Los Angeles, Calif.*

Circle **505** on Time-Saver Card

Compressor Drive Motors . . . with speeds to 22,000 rpm

Used on fighter aircraft. Rated 2 hp continuous duty at 3750 rpm, and 3.5 hp intermittent duty. Voltage 208, 3 phase, 400 cycle. Has

Continued on page 124

it gives— and it takes

The seal is synthetic rubber-impregnated fabric, bonded with a pliable, resilient synthetic rubber filling. This combination will stand up to severe punishment and is impervious to the action of hydraulic fluids. The even flow of the filling ensures no down-at-heel wear from fluid pressure distortion.

the higher the pressure— the better the seal

Pile on the pressure—"Hallprene" will meet it *and* retain a seal even if the fluid pressure falls to zero.

NOTHING

GETS PAST

Hallprene

BRITISH PATENT NO. 734935
CANADIAN PATENT NO. 547[illegible]
U.S.A. PATENT NO. 2,75[illegible],118

Pressure-proof—drip-proof—air-proof—oil-proof—*NOTHING* can squeeze past Hallprene Patent Fluid Seals. Built to take high pressure punishment, Hallprene seals are tough—EXTRA tough. For POSITIVE and PERMANENT sealing.

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the seals that pressure can't lick

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in Kel-F, Viton-A, Vyram, Polyurethane, and other unusual elastomeric materials having excellent resistance to many petroleum oils, synthetic lubricants, fuels, phosphate and silicate ester fluids—in a temperature range of —40° to +500° F.

LINEAR—specialists in close-tolerance molding in all of today's modern polymers . . . in both fabric reinforced and homogeneous materials.

These are automatic seals. For further help, call the LINEAR engineer.

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Circle **87** on Time-Saver Card

AVIATION COMPONENT DATA

self-contained shroud and 200 cfm cooling fan. Mounting flange is modified AND-20001. Sizes to 25 hp also available. Speeds to 22,000 rpm on 400 cycle. Special units for 60 cycle. Also used for driving hydraulic pumps.—*Hoover Electric Co., Columbus, Ohio.*

Circle **506** on Time-Saver Card

Air Regulator . . . has 8000 psi proof pressure

Lightweight, delivers 0 to 5000 psi constant outlet pressure. For laboratory instrumentation or qualification testing. Low-torque hand

control, or electric remote control of outlet pressure. Temperature range —65 to 275 F with inlet pressures to 6500 psi. Positive shut-off.—*Benbow Mfg. Corp., Culver City, Calif.*

Circle **507** on Time-Saver Card

Solenoid Valve . . . is fast acting

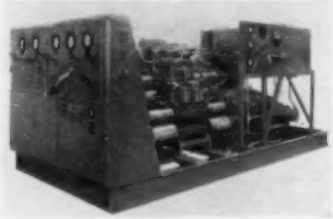
For use with air or nitrogen. Built for missiles or manned air-

craft. Valve No. 872458 has an operating pressure range of 80 to 3250 psi and a burst pressure rating of 8125 psi. For ambient temperatures —65 to 160 F. Operates on 18 to 30 volts dc. Weight 1.4 lbs. Response time .018 sec.—*Walter Kidde & Co., Inc., Belleville, N. J.*

Circle **508** on Time-Saver Card

Booster Compressor . . . is hydraulically driven

Model 13457 compresses high pressure gas for testing. Packing requires no lubrication, assuring

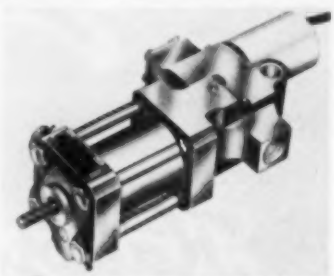


contamination-free operation. A dual first and second stage gives high capacity at 4000 psi. A third and fourth stage delivers lower capacity at 9000 psi. A 60-hp hydraulic system drives the unit. Capacity from 40 to 400 cfm.—*Haskel Engineering & Supply Co., Glendale, Calif.*

Circle **509** on Time-Saver Card

Air & Oil Actuators . . . are solenoid-controlled

Very low leakage, even with helium. Model 106-2 has a pressure range of 50 to 750 psi, and a temperature range of —80 to 275 F.



Port size AND 10040-4, stroke 1.6 in., and rod dia 5/16 in. Weight 1.7 lbs. Other units for pressures to 3000 psi and temperatures to 500 F.—*Waldorf Fluid Systems Div., Waldorf Instrument Co., Huntington Station, N.Y.*

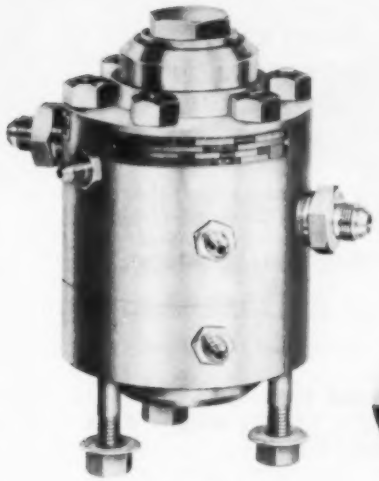
Circle **510** on Time-Saver Card

O-Rings . . . for high temperature

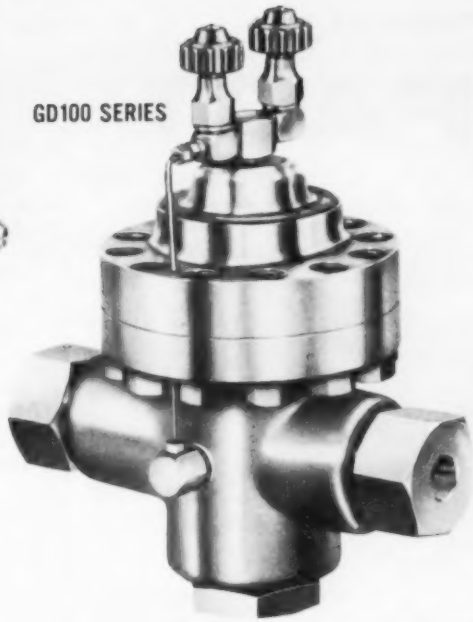
New compound No. N-304-7 is being used for molding O-rings. It meets the requirements of MIL-P-25732 (ASG). O-rings have a temperature range of —65 to 275 F. They are made in all standard

Continued on page 126

Circle **148** ➡



GD60 AND 80 SERIES



GD100 SERIES

GD700 SERIES

Control gases safely, accurately

to 15,000 psi and 200,000 scfh with VICTOR REGULATORS

You get precise regulation of high pressure gases with large flow rates, because Victor employs gas pressure to control the regulating diaphragm. The result is accurate delivery from 5 to 15,000 psi with inlet pressures to 15,000 psi . . . plus ability to obtain flows in excess of 200,000 scfh at maximum inlet and outlet pressures. Chart below shows operating range of standard models.

MODEL NO.	MAX. INLET PSI	MAX. OUTLET PSI	FEATURES	MAX. FLOW SCFH
GD10	3,600	500	Single adjustment regulator control	15,000
GD30	2,500	2,500	Load & bleed valve control	25,000
GD31	3,600	3,600	Load & bleed valve control	36,000
GD61C	2,500	2,500	Load & bleed valve control	10,000
GD62C	3,600	3,600	Load & bleed valve control	12,000
GD65	6,000	6,000	Load & bleed valve control	15,000
GD65C	7,000	7,000	Load & bleed valve control	15,000
GD80A	5,000	5,000	Load & bleed valve control	30,000
GD81A	10,000	10,000	Load & bleed valve control	50,000
GD86R	10,000	10,000	For remote control only	75,000
GD100R	6,000	6,000	For remote control only	240,000
GD100	6,000	6,000	Load & bleed valve control	240,000
GD700	7,000	7,000	Single adjustment regulator control; self relieving	15,000
SR10	3,600	1,000	Small, spring loaded regulator	200
LR20B	7,000	7,000	Spring loaded regulator; self relieving	120

Operating temperature range: −67 F. to +250 F.

. . . Yours for the asking
Take advantage of Victor's long experience with high pressure gas regulation to help solve your special problems involving flow rates, delivery pressures, corrosive fluids and temperature compensation. Write, wire or phone us today. No obligation.

All models listed are field proved. Most are designed for panel mounting or remote control. They regulate all non-corrosive gases, including oxygen. Stainless steel models available for corrosive gases and pressures above 10,000 psi. For complete specifications, write for Victor High Pressure Regulator sheets.

VICTOR for regulators

VICTOR EQUIPMENT COMPANY

Mfrs. of High Pressure and Large Volume Gas Regulators; welding & cutting equipment; hardfacing rods; blasting nozzles; cobalt & tungsten castings; straight-line and shape cutting machines

844 Folsom St., San Francisco 7 • 3821 Santa Fe Avenue, Los Angeles 58 • 1145 E. 76th St., Chicago 19

J. C. Menzies & Co., Wholly-Owned Subsidiary

Circle **51** on Time-Saver Card

COMPACT

The Fisher differential pressure switch

actual size

$27.20 list

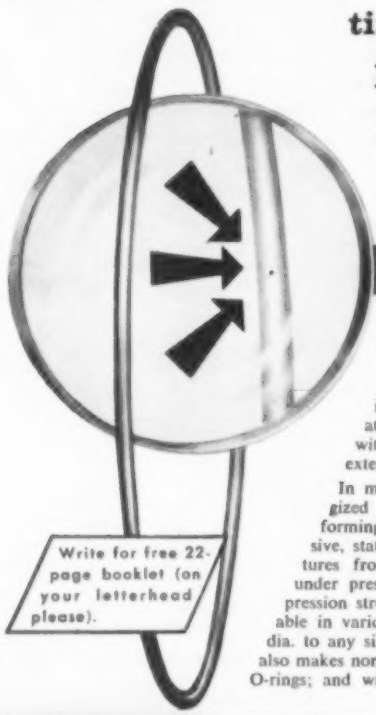
Weighs only 4 ounces

Tamperproof differential adjustment from 10 to 2000 psi

Manufacturers representatives' inquiries invited

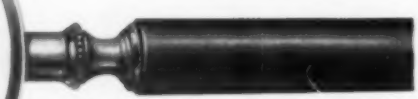
FISHER CONTROLS, INC.

1928 Lincoln Blvd. • Santa Monica, California



tiny holes assure pressure tight seals

United's *exclusive patented* feature



United's exclusive, patented* self-energized metallic O-rings have tiny holes in the hollow ring wall. The holes are to balance the interior and exterior pressures in order that the ring may respond to variation in deflection of the sealing surfaces with a natural resilience uninhibited by the external pressure.

In metal-to-metal applications, self-energized metallic O-rings are capable of forming positive, permanent, non-corrosive, static seals under extreme temperatures from —321°F. to 1800°F., and under pressures equal to ultimate compression stress of the metal itself. Available in various metals and finishes, 3/16" dia. to any size or configuration. United also makes non-vented and pressure-filled O-rings; and wire and brazing O-rings.

Write for free 22-page booklet (on your letterhead please).

PATENTS 2,809,269; *2,837,360

UNITED METALLIC "O" RING CORP.

Dayton, Ohio • Box 1038

Division of United Aircraft Products, Inc.

Circle **140** on Time-Saver Card

AVIATION COMPONENT DATA

sizes. For military aircraft they are made in MS28775 series in bonded stock packages.—*Parker Seal Co., Division of Parker-Hannifin Corp., Cleveland, Ohio.*

Circle **511** on Time-Saver Card

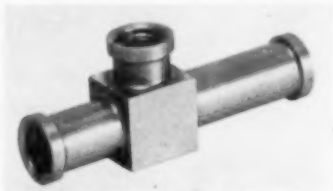
Thermal Relief Valve . . . weighs 6 oz

Model EA-1225 is qualified and meets AN6245B4 and MIL-V-5527A. Temperature range —65 to 400 F, with pressures to 4100 psi. Maximum flow 1 cu in. per min. To qualify, valve was subjected to 6150 psi at 400 F, and cycled 10,000 times.—*Electrol Inc., Kingston, N. Y.*

Circle **512** on Time-Saver Card

Regulating Valve . . . pressurizes fuel tank

Keeps constant pressure in line or tank while fuel is being used. Can be used in accumulators, piston actuators, or as a constant pressure source. Valve has built-in pressure relief, and reverse check. Weight 0.15 lb. Temperature range —65 to 300 F. Inlet pressure range 15 to 70 psi. Made in 3/8-in. line size.—*Aero Supply Mfg. Co., Inc., Corry, Pa.*



Circle **513** on Time-Saver Card

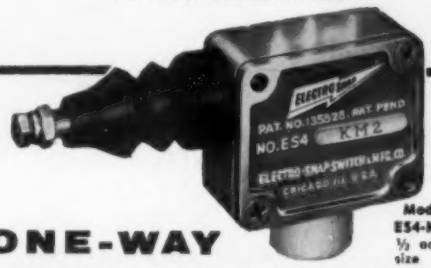
O-Ring Compound . . . has low compression set

Developed for Skydrol 500 and Skydrol 7000. Gives good service with any phosphate ester base hydraulic fluid. Features low compression set and resistance to swelling and deterioration. Identified as 9078D, it gives increased life under severe service conditions.—*Precision Rubber Products Co., Dayton, Ohio.*

Circle **514** on Time-Saver Card

Continued on page 128

Circle **49** on Time-Saver Card



Model ES4-KM2 ½ actual size

ONE-WAY IMPULSE SWITCH

simplifies sequencing circuits

- ★ Eliminates Interlocking Switches and Complicated Actuating Dogs
- ★ Exclusive one-way actuator sends electrical pulse when depressed, then opens circuit. No pulse on actuator return.
- ★ Gives More Dependable Operation — replaces complicated controls
- ★ Lowers Cost of Control Circuits— fewer switches required
- ★ Faster Automatic Operation — closer sequencing possible

10 amps, 125v AC

Four models available with pulsing strokes from 1/16" to 3/8".

Described in Data Sheet ESF-3

$10.50

plus 25c shipping

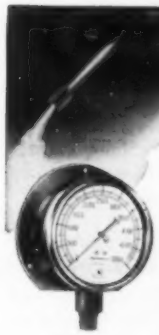
Write for Quantity Discounts

ELECTRO SNAP

ELECTRO-SNAP CORPORATION

4224 W. Lake St., Chicago 24, Ill.

First choice of the rocket and missile industry...



Three superlative Marsh products are widely used and approved by the aircraft and missile industry:

MARSH Pressure Gauges...

because they combine the most advanced features ever found in pressure, vacuum and compound gauges. There is a Marsh Gauge for every conceivable application.

MARSH Needle Throttling Valves...

because they are guaranteed to give micrometer regulation at HIGH pressures—pressure up to 10,000 psi—and any temperature up to 500° F.

MARSH Dial Thermometers...

because they offer the precision and accuracy a precision industry demands. Most complete line; wide temperature ranges, dial sizes, patterns, finishes.

All Marsh products available with AND threads

MARSH *New catalog covers all details*

MARSH INSTRUMENT CO., *Sales Affiliate of Jas. P. Marsh Corp.* **Dept. 19, Skokie, Ill.**

Marsh Instrument & Valve Co., (Canada) Ltd., 8407 103rd St., Edmonton, Alberta, Canada. Houston Branch Plant, 1121 Rothwell St., Sect. 15, Houston, Texas

Circle **91** on Time-Saver Card

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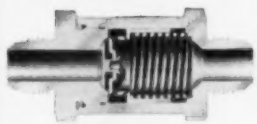
ground support and test equipment

REPUBLIC VALVES

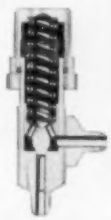


FREE-FLOW CHECK VALVES

No leakage. 3000 psi. Very low pressure drop. Can be furnished to open at ¼ to 35 psi. Brass, stainless steel, or aluminum alloy. ⅛" to 2" pipe or tube. Temp. range -65° to 200°F.

RELIEF VALVES

Quick unloading, smooth operation. Guided shut-off piston with stainless steel or Nylon seat. Pressure range to 4000 psi. Brass, aluminum alloy, or stainless steel. ⅛" to ¾" pipe or tube. Temp. range to 400°F.



HAND PUMP

For hydraulic applications on missile carrier and support equipment. Double-acting. 2 cu. in. displacement per cycle. 1000 psi. working pressure. Aluminum alloy body, stainless steel trim. -65° to 160°F.

LEVELATOR VALVE

For automatically maintaining height and level condition in any vehicle with air spring suspension. Controls swaying in transit, and off-level position while standing. Applicable to trucks, buses, trailers, carriers, cranes, etc.

LO-TORQ SELECTOR VALVES

Smooth, easy operation, with low turning torque because of pressure balancing design. 0 to 6000 psi. Bronze, steel, or aluminum alloy. ⅛" to 2" pipe or tube. 2, 3, 4 ports.

DUAL HAND PUMP

2 pumps, 2 relief valves, and 2 needle shut-off valves, compactly manifolded for elevating mechanisms, hydraulic applications on ground support equipment, etc. Aluminum alloy body, stainless steel trim. -65° to 160°F.

Distributors in principal cities coast to coast

RM **REPUBLIC MANUFACTURING CO.**

15655 BROOKPARK ROAD • CLEVELAND 35, OHIO

Circle **118** on Time-Saver Card

POINT OF
SAFE RETURN...

IMPENDING BY-PASS
FUEL FILTER

CHANCES ARE . . .
THE TURBINE OR JET POWERED PLANE
YOU ARE NOW WORKING ON WILL DEMAND
THIS NEW AERO SUPPLY DEVELOPMENT

PATENT APPLIED FOR

THE PRIMARY FILTER ELEMENT SIGNALS IT'S BEING CLOGGED HOURS BEFORE THE RELIEF VALVE OPENS! AT THIS POINT, THE FILTER ACTUATES A SIGNAL . . . THEN, A STANDBY SECONDARY FILTER ELEMENT GOES INTO OPERATION. THERE'S STILL TIME TO COMPLETE THE MISSION AND MAKE A SAFE RETURN.

REQUEST BULLETIN #59-125 FOR COMPLETE TECHNICAL INFORMATION OR CONTACT OUR SALES REPRESENTATIVES . . . AIR SUPPLY COMPANY IN THE WEST . . . AERO ENGINEERING COMPANY IN THE EAST . . . GARRETT MFG. CORP. IN CANADA.

A NEW Development Of The
AERO SUPPLY MFG. CO. INC.
CORRY, PENNSYLVANIA

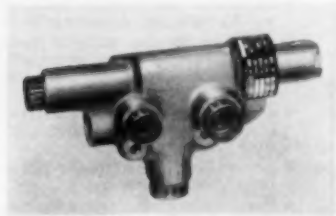
ELECTRO-MECHANICAL DEVICES • ENGINEERED FLUID CONTROL SYSTEMS • PRECISION MANUFACTURING

Circle **5** on *Time-Saver Card*

AVIATION COMPONENT DATA

Brake Lock-out Valve . . . weighs less than 1 lb

Pressure operated, accurate sequencing, and zero leakage. Built-



in thermal relief and pressure check valve. Pilot pressure can be air or hydraulic fluid. Operating pressures to 4000 psi and temperatures to 260 F.—*Conair, Inc., Glendale, Calif.*

Circle **515** on *Time-Saver Card*

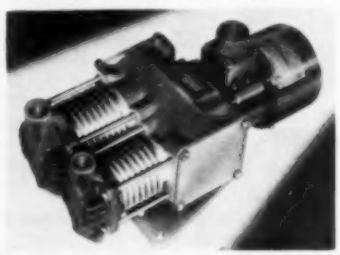
Pressure Gages . . . have no linkage

A helically wound bourdon tube directly connected to the pressure source is the only moving part. Pressure in the tube causes it to unwind, sweeping pointer at the other end across the dial. No linkage to wear. Pressure ranges to 50,000 psi. Complete specifications available in 8-page catalog.—*Glassco Instrument Co., Pasadena, Calif.*

Circle **516** on *Time-Saver Card*

Air Pump . . . needs no lubrication

Has minimum life of 1000 hours under continuous duty. Operating temperature range —65 to 200 F. Capacity .025 ppm at 30 psi abso-



lute, with 7 in. Hg inlet pressure. Fully enclosed ¼-hp, 400 cycle, 3 phase, 208-volt, fan cooled motor. Weight 8.75 lbs.—*Great Lakes Manufacturing Co., Cleveland, Ohio.*

Circle **517** on *Time-Saver Card*

7th Annual Competition

1959 FLUID POWER PRIZE PAPER CONTEST

Articles about:
HYDRAULIC AND PNEUMATIC SYSTEMS AND COMPONENTS

DESIGN • APPLICATION • MAINTENANCE

FIRST PRIZE	$500
SECOND PRIZE	$300
THIRD PRIZE	$200
4th to 7th PRIZES, EACH	$100

All prize papers will be published in APPLIED HYDRAULICS & PNEUMATICS Magazine. Papers receiving honorable mention awards will also be published during 1960 and paid for at regular rates.

CONTEST CLOSES JULY 1, 1959

Committee of Judges:

S. H. Durbin, Associate Chief Engineer, E. W. Bliss Company
O. S. Perkins, Engineer-In-Charge, Hydraulic Crane Division, Bucyrus-Erie Company
C. H. Cannon, Mechanical Systems Engineer, Lockheed Aircraft Corp.

SPONSORED BY APPLIED **Hydraulics & Pneumatics**

An Industrial Publishing Corporation Magazine
812 HURON ROAD, CLEVELAND 15, OHIO

To Receive A Contest Rules Booklet Circle 240 On Time-Saver Card

YOU NAME THE APPLICATION... ASHCROFT GAUGES MEET *EVERY* REQUIREMENT

For more than 100 years the name Ashcroft has stood for the most advanced pressure gauge research, design and engineering. By anticipating the constantly changing and expanding needs of all industrial users, we have combined in Ashcroft Gauges the highest degree of accuracy and long-life service for every type of installation. You can select dial sizes ranging from 2" through 24" . . . pressures from 30" vacuum or a few ounces up to 100,000 psi . . . materials that meet all service demands.

There are three classes of Ashcroft Gauges. Each class has functional characteristics suited to the applications for which it is recommended.

DURAGAUGES. The finest pressure gauges built. Highest accuracy and durability make them ideal for the toughest services. They save many times their original cost in replacements and repairs.

QUALITY GAUGES. The finest general-purpose gauges made. Second only to the Duragauge in ruggedness and sustained accuracy. Available for pressure, vacuum or compound services in low, medium and high ranges.

STEEL CASE GAUGES. The best gauges for small equipment like portable compressors, pumps, and for less important pressure lines. Pressure, vacuum and compound ranges available.

Among the many Ashcroft Gauges are Maxisafe®, pneumatic receiver, recording, chemical and special application gauges, plus a variety of gauge testers. Get all the facts. Learn why Ashcroft Gauges are the best investment you can make. *Write for Catalog 300B.*

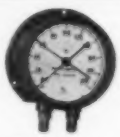
Quality Gauge No. 1010 for general applications.

Quality Gauge No. 1056 for hydraulic presses.

Quality Gauge No. 1000 for small equipment.

Special Purpose Gauge No. 1009. Heavy-geared.

Vibration-Resistant Gauge No. 1122. Heavy-duty gearless.



Duplex Gauge No. 1038 A. Indicates two pressures on dial.

ASHCROFT PRESSURE GAUGES

A product of

MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Stratford, Connecticut
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

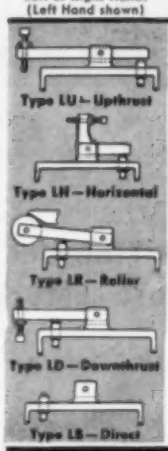
Circle **94** *on Time-Saver Card*

Circle **15** *on Time-Saver Card*

Pneu-Trol TIME DELAY CONTROL SWITCH

. . . Gives Cylinder Applications Greater Efficiency Accuracy . . . Wider Use!

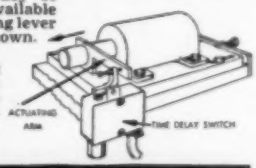
For any type actuation Left or Right Hand. (Left Hand shown)



- **Holds Cylinder dwell accurately to fraction of second.**
- **Automatically re-sets.**
- **Simple, Compact, Rugged.**

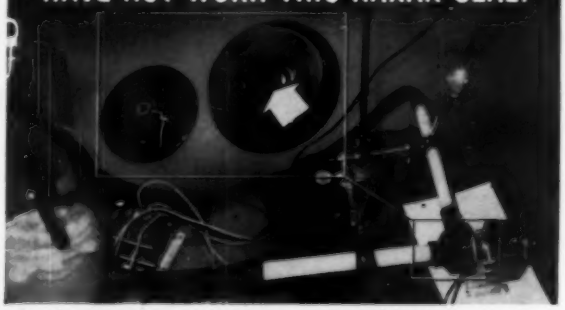
You can hold any motion or operation controlled or actuated by air or hydraulic cylinders at a positive stop on either end of the stroke for ¼ to 60 seconds in 20 to 1 ratios with Pneu-Trol Time Delay Control Switches. Simple in design with positive hydraulic timing action . . . compact and easily mounted on the machine or fixture, Pneu-Trol Switches are providing millions of trouble-free actuations in solenoid-operated cylinder applications of every type. Positive, controlled time dwell permits wider use of air or hydraulic power in automatic operations, increases accuracy of work by insuring split-second accuracy of the dwell. Available with 5 actuating lever linkages as shown.

Switch mounted to provide dwell at end of power stroke of single action, spring return cylinder.



PNEU-TROL, INC.
A DIVISION OF AUTO-PONENTS, INC.
2919 W. Grant Street • Bellwood, (Chicago Suburb) Illinois

5,000+ MILES OF SPINNING STEEL HAVE NOT WORN THIS KARAK SEAL!



No leakage in 1,300 hours, as a 3/8" dia. impeller insert revolves at 3,600 rpm, against a KARAK grade W126-5 Seal, while pumping a highly caustic solution

SPECIFY KARAK W126-5 SEALS whenever "difficult" solutions are pumped: acids, caustics, ketones, halogens, the alcohols, aromatics, carbon tet, freon, etc. Its special qualities resist erosion and rapid wear ordinarily caused when strong solutions act upon other carbon-graphites by loosening the bond, freeing carbon and graphite particles.

SPECIFY KARAK W126-5 SEALS whenever the mating face is Hastelloy C or D; cast iron; brass; stainless steels 303, 310, 416, 420; hard chrome plate; Inconel; Monel; Stellite 12, another carbon-graphite, or a ceramic. (Ceramics quickly gather carbon-graphite and become excellent bearing surfaces.)

Request new, FREE complete KARAK technical brochure

The OHIO CARBON COMPANY
12508 Berea Rd., Dept. 287, Cleveland 11, Ohio

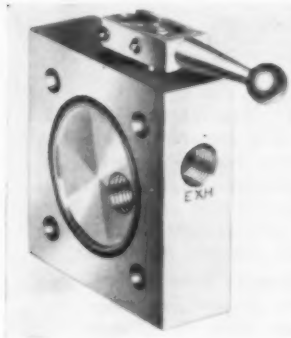
Circle **105** *on Time-Saver Card*

NEW PRODUCTS

LEVER-OPERATED VALVE
. . . is streamline thin

Designation: Slim Line

Features: Easily mounted, even in limited spaces. Milled from solid aluminum bar stock. Chambers formed with metal spacers held rigidly in metal-to-metal end abutment. Suited for air, oil or water.



Pressures to 125 psi. Temperatures to 150 F and available tapped for either ⅛ or ¼ inch pipe connection.

Specifications: Sides counterbored 1¾ inch in diameter, and .055 inch deep. Machined for an O-ring and provided with four through holes, permitting valves to be manifolded together in any of four 90° angle positions.

Hunt Valve Co.
Salem, Ohio

Circle **311** on Time-Saver Card

FILTER
. . . has monel screen

Features: Protects hydraulic valves and flow-meters. Quick-couplers on inlet and outlet enable the operator to quickly clean the filter ele-

ment and use again. Elements will withstand 150 psi differential.

Specifications: Made 20 to 700 mesh. Pressures to 300 psi, temperatures to 450 F. Bronze, steel, or 316 stainless steel as required.

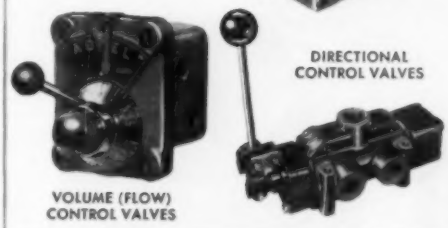
Ronningen-Petter Co.
Vicksburg, Mich.

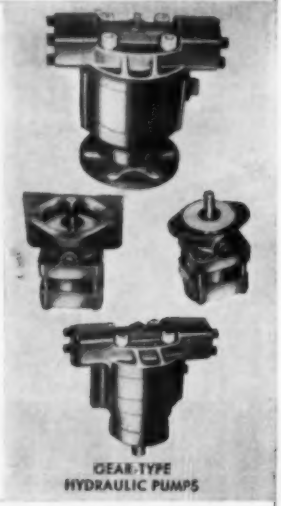
Circle **312** on Time-Saver Card

Continued on page 132

ADEL *Reliability in Your Hydraulic Systems*

BETTER MACHINE CONTROL...
FOR BETTER MACHINE PERFORMANCE





New Industrial Gear Type Hydraulic Pumps with capacities from ¼ to 35 GPM at pressures to 1500 PSI and speeds to 3600 RPM.

The diagrams show but two of innumerable circuits and systems where these versatile pumps and control valves can be used to advantage.

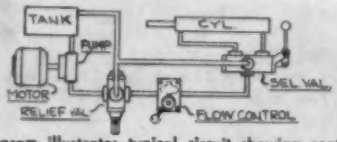


Diagram illustrates typical circuit showing control of cylinder.

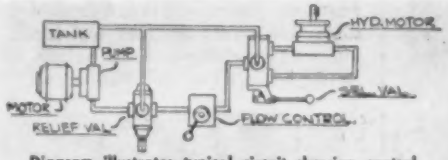


Diagram illustrates typical circuit showing control of hydraulic motor.

For metal working machines, industrial equipment, farm machinery, construction equipment, motor vehicles and marine applications... *Specify* ADEL *Precision-Engineered Hydraulics* for every mechanical operation in every industry.

Complete engineering specifications are available upon request.

Reliability
ADEL PRECISION PRODUCTS
A DIVISION OF GENERAL METALS CORPORATION

1444 WASHINGTON AVENUE, HUNTINGTON 4, WEST VIRGINIA

DISTRIBUTORS:

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CALIFORNIA
Calpacific Equipment Co.
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Teglen Engineering Co., Inc.
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COLORADO
E. C. Wild Company
695 So. Garfield St., Denver 9

CONNECTICUT
Air & Hydraulic Engineering Co., Inc.
986 Howe St., New Haven

ILLINOIS
Catching Engineering
9242 Broadway, Brookfield

INDIANA
Neff Engineering Company
2509 Washington Ave., Evansville
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NEW YORK
Tri-State Supply Co.
11 Stone Ave., Brooklyn 33

OHIO
Industrial Air & Hydraulic Equipment Company
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Wyatt Sales Corporation
1900 Euclid Ave., Cleveland 15

OREGON
Ray Bobbs Air-Draulics Inc.
218 S.E. 12th Ave., Portland 14

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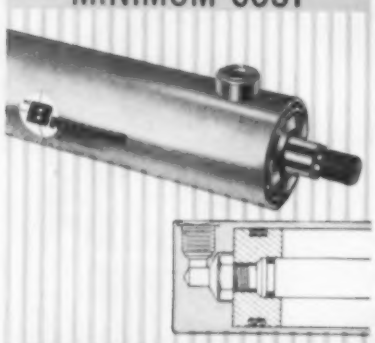
Milwaukee 17

Circle **4** on Time-Saver Card

USE ONE OF THESE

3000 PSI

MAXIMUM QUALITY
MINIMUM COST



DECCTO
CYLINDER

Save Weight—Space—Cost

Check these advantages:

- Clean, compact design.
- Exclusive "Bruning-ized" bore.
- Extremely wide selection of bores, rod diameters and mounting combinations.
- For both hydraulic and pneumatic applications.
- 3000 PSI operating pressure.
- Rugged, dependable performance.
- Easily adapted to customer specials.
- Premium quality.
- Highly competitive prices.

COMPARE PRICE AND DELIVERY

For original equipment or replacement parts specify Bruning DECCTO cylinders.

Bruning has a complete line of high performance hydraulic and pneumatic couplers, cylinders and check valves.

WRITE FOR FREE BULLETIN
No. 554-18

the BRUNING COMPANY

609 So. 9th St., Lincoln, Nebraska

Circle **26** on Time-Saver Card

NEW PRODUCTS

SERVO VALVE
. . . to 3000 psi

Designation: Model A27

Features: Meets requirements of high reliability and fast response required in fluid power drives of numerical and template controlled machine tools.

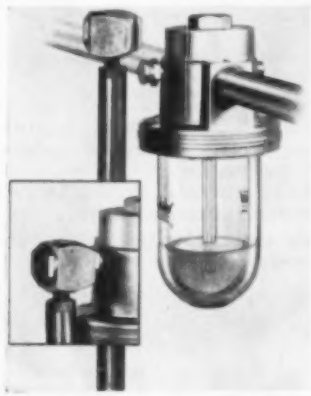
Specifications: Rated flow of 6 gpm. For operating pressures to 3000 psi.

Bendix Aviation Corp.
Hamilton Division
Hamilton, Ohio

Circle **313** on Time-Saver Card

REMOTE FILLER
. . . saves maintenance time

Features: Permits quick filling of lubricator bowls without interfering with production. Uses button-head fitting for installation on



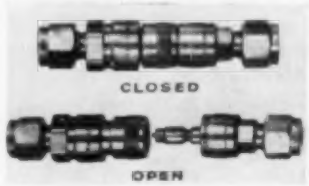
either side of lubricator body. Button-head coupler is mounted on end of a rigid extension of oil delivery line. Using lubricator body flange as guide, these two fittings are easily engaged. Oil from portable hand pump sent through delivery line into bowl.

Hannifin Co.
Parker-Hannifin Corp.
Des Plaines, Ill.

Circle **314** on Time-Saver Card

QUICK-CONNECT FITTING
. . . has unique shutoff

Designation: Swagelok



Features: Instant-acting seals in both parts of unit. No pressure loss from either end of line when fitting is disconnected. Easy straight-line fingertip pull or push action assures vacuum-tight seal. Fitting used with portable equipment.

Specifications: Sizes ¼ to ⅜ inch OD tube in steel, stainless steel and brass. Buna "N" O-rings.

Crawford Fitting Co.
Cleveland, Ohio

Circle **315** on Time-Saver Card

HYDRAULIC POWER UNITS
. . . in kit form

Designation: Denasco-Kit

Features: Heavy-duty unit in kit form for do-it-yourself assembly. No drilling, tapping, cutting or

welding required. Follow illustrated instructions for assembly. Operation and maintenance manual, circuit diagram with each unit.

Specifications: Up to 28 gpm with pressures to 3000 psi. Over 150 models. Extra-large oil reservoirs, protected internally with oil-resistant enamel.

Ditzen Engineering & Sales Co.
Oakland, Calif.

Circle **316** on Time-Saver Card

Continued on page 136

USE ONE OF THESE TIME-SAVER CARDS...

...for more information on advertised products, new components, useful literature, etc. Just circle item number and drop in the mail.

New Products

Descriptions start on page 56

IN-LINE RELIEF VALVE 300
Republic Mfg. Co.
AIR & OIL CYLINDERS 301
S-P Mfg. Corp.
PRESSURE CONVERTER 302
Econ-O-Gage Co.
AIR-OIL BOOSTERS 303
Wilton Tool Mfg. Co.
CONTROL VALVES 304
Gresen Mfg. Co.
CONTROL VALVE 305
Sinclair-Collins Valve Co.
CHECK VALVES 306
Denison Engineering Div.
HYDRAULIC FILTERING SYSTEM 307
The Rosaen Co.
POPPET CONTROL VALVE 308
Valvair Corp.
MOMENTARY CONVERTER 309
Hause Machines, Inc.
SOLENOID VALVES 310
Barksdale Valves
LEVER-OPERATED VALVE 311
Hunt Valve Co.
FILTER 312
Ronningen-Petter Co.
SERVO VALVE 313
Bendix Aviation Corp., Hamilton Div.
REMOTE FILLER 314
Hannifan Co., Parker Hannifin Corp.
QUICK-CONNECT FITTING 315
Crawford Fitting Co.
HYDRAULIC POWER UNITS 316
Ditzen Engineering & Sales Co.
MECHANICAL SEAL 317
Sealol Corp.
SUMP FILTER 318
Dollinger Corp.
LONG LIFE SOLENOIDS 319
Automatic Switch Co.
TUBE FITTING 320
Flodar Corp.
PLUG VALVE 321
Circle Seal Products Co.
4-WAY AIR VALVE 322
Mechanical Air Controls, Inc.
SOLENOID VALVE 323
Barksdale Valves
PRESSURE GAGE 324
Helicoid Gage Div., American Chain & Cable Co.
THREE-WAY VALVE 325
Valcor Engineering Corp.
BLOCK PANEL 326
Petch Mfg. Co.
THREE-WAY AIR VALVE 327
A. Schrader's Son, Div. of Scovill Mfg. Co.
TWO-PART ACCUMULATOR 328
Special Products Co.
DISPOSABLE ACCUMULATOR 329
Greer Hydraulics, Inc.
TIMER MAINSPRING 330
M. H. Rhodes, Inc.
PLUNGER PUMP 331
Union Steam Pump Co.
LEAKPROOF ACCUMULATOR 332
Narda Hydraulics Corp.
AIR COMPRESSORS 333
Davey Compressor Co.
AIR FILTER 334
Wilkerson Corp.
MANUAL CONTROL ON RELIEF 335
Webster Electric Co.
FLOW RATE TRANSDUCER 336
Ramapo Instrument Co.
AIR REGULATORS 337
The Bellows Co.
GAUGE PROTECTOR 338
Circle Seal Products Co., Inc.
SYNTHETIC COMPOUND 339
Parker Seal Co., Div. of Parker-Hannifin Corp.
DIRECTIONAL CONTROL VALVES 340
Webster Electric Co.
AIR CONTROL VALVES 341
Valvair Corp.
HOSE ASSEMBLIES 342
Parker Fittings & Hose Div., Parker-Hannifin Corp.
PRESSURE SWITCH 343
Barksdale Valves

MARCH, 1959

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ADVERTISERS

1	21	41	61	81	101	121	141	161	181	201	221
2	22	42	62	82	102	122	142	162	182	202	222
3	23	43	63	83	103	123	143	163	183	203	223
4	24	44	64	84	104	124	144	164	184	204	224
5	25	45	65	85	105	125	145	165	185	205	225
6	26	46	66	86	106	126	146	166	186	206	226
7	27	47	67	87	107	127	147	167	187	207	227
8	28	48	68	88	108	128	148	168	188	208	228
9	29	49	69	89	109	129	149	169	189	209	229
10	30	50	70	90	110	130	150	170	190	210	230
11	31	51	71	91	111	131	151	171	191	211	231
12	32	52	72	92	112	132	152	172	192	212	232
13	33	53	73	93	113	133	153	173	193	213	233
14	34	54	74	94	114	134	154	174	194	214	234
15	35	55	75	95	115	135	155	175	195	215	235
16	36	56	76	96	116	136	156	176	196	216	236
17	37	57	77	97	117	137	157	177	197	217	237
18	38	58	78	98	118	138	158	178	198	218	238
19	39	59	79	99	119	139	159	179	199	219	239
20	40	60	80	100	120	140	160	180	200	220	240

NAME .....

POSITION: .....

COMPANY: .....

PRODUCT MFG.: .....

STREET .....

CITY ..... ZONE ..... STATE .....

Do not use after 6-15-59

NEW PRODUCTS

300	305	310	315	320	325	330	335
301	306	311	316	321	326	331	336
302	307	312	317	322	327	332	337
303	308	313	318	323	328	333	338
304	309	314	319	324	329	334	339

FREE LITERATURE

400	405	410	415	420	425	430	435
401	406	411	416	421	426	431	436
402	407	412	417	422	427	432	437
403	408	413	418	423	428	433	438
404	409	414	419	424	429	434	439

AVIATION DATA

500	505	510	515	520	525	530	535
501	506	511	516	521	526	531	536
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Useful Literature

Descriptions start on page 62

POWER UNITS 400
Spencer Hydraulic's Inc.
FLUID POWER EQUIPMENT 401
The Oilgear Co.
MOTORIZED SELECTOR VALVE 402
United Hydraulics, Inc.
SUB-MINIATURE SWITCHES 403
Unimax Switch Div.
QUICK COUPLERS 404
OPW-Jordan
AIR-LINE FILTER 405
Perfecting Service Co.
OIL CONDITIONERS 406
Mayhew Products Co.
DETAILED FASTENER LINE UP 407
Standard Pressed Steel Co.
MANOMETERS 408
King Engineering Corp.
TEFLON HANDBOOK 409
Halogen Insulator & Seal Corp.
PANEL FABRICATION TECHNIQUE 410
Petch Mfg. Co.
FORGED COUPLETS 411
H. K. Porter Co.
REDUCING VALVE 412
Atlas Valve Co.
SERVO PRESET UNIT 413
Servocontrol, Div. of Oilgear Co.
VAN-AIR DRYER 414
Van Products Co.
SHAFT SEALS 415
Syntron Co.
FLOW DIVIDER 416
Fluid Controls, Inc.
LIMIT SWITCHES 417
Micro Switch
FITTINGS & FLANGES 418
Babcock & Wilcox Co., Tubular Products Div.
FLEXIBLE VINYL GROMMET 419
LMR Engineering Corp.
MAGNETIC STARTERS 420
Cutler-Hammer Inc.
SILICONE PRODUCTS 421
Dow Corning Corp.
GLOBE VALVES 422
R-P&C Valve Div., American Chain & Cable Co.
DISOGRIN 423
Disogrin Industries
FLUID LINE CLAMP PLIERS 424
TA Mfg. Co.
MOTOR SELECTOR 425
Reliance Electric & Eng. Co.

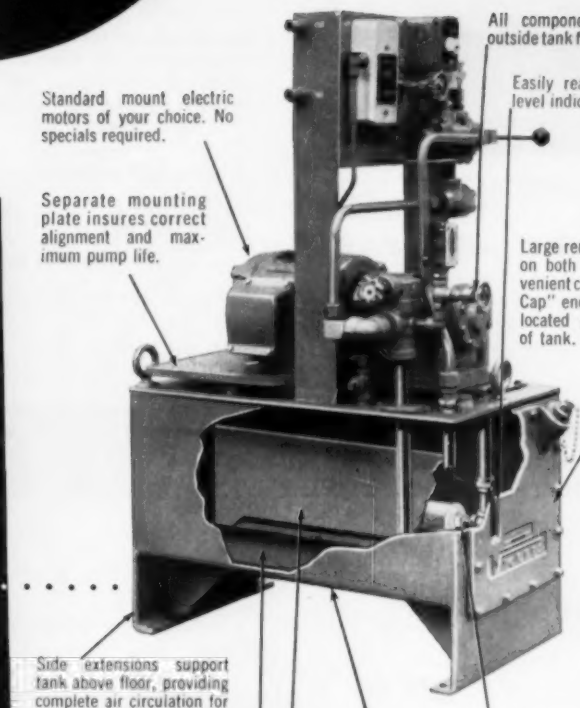
Aviation Component Data

Descriptions start on page 120

HYDRAULIC PUMP/MOTOR 500
Pesco Products Div., Borg-Warner Corp.
FOUR-WAY VALVE 501
M. C. Mfg. Co.
DESIGN BOOKLET ON SILICONES 502
Dow Corning Corp.
QUICK DISCONNECT COUPLINGS 503
Airaterra
STATIC SEAL 504
Navan Products Inc.
CELLULOSE FILTER PACK 505
Luber-finer Inc.
COMPRESSOR DRIVE MOTORS 506
Hoover Electric Co.
AIR REGULATOR 507
Benbow Mfg. Corp.
SOLENOID VALVE 508
Walter Kidde & Co., Inc.
BOOSTER COMPRESSOR 509
Haskel Engineering & Supply Co.
AIR & OIL ACTUATORS 510
Waldorf Fluid Systems Div.,Waldorf Instrument Co.
O-RINGS 511
Parker Seal Co., Div. of Parker-Hannifin Corp.
THERMAL RELIEF VALVE 512
Electrol Inc.
REGULATING VALVE 513
Aero Supply Mfg. Co., Inc.
O-RING COMPOUND 514
Precision Rubber Products Co.
BRAKE LOCK-OUT VALVE 515
Conair, Inc.
PRESSURE GAGES 516
Giassco Instrument Co.
AIR PUMP 517
Great Lakes Mfg. Co.

You save money and time applying Hydraulics when you buy the . . .

VICKERS *package . . . . . instead of parts*

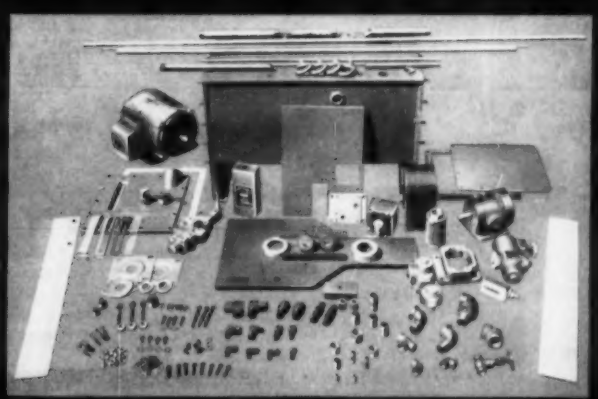

All components mounted outside tank for easy access.
Easily read accurate fluid level indicator.
Standard mount electric motors of your choice. No specials required.
Separate mounting plate insures correct alignment and maximum pump life.
Large removable covers on both ends for convenient cleaning. "Filler Cap" end cover can be located at either end of tank.
Side extensions support tank above floor, providing complete air circulation for maximum heat rejection.
Corrosion protection—internal tank surfaces sand-blasted and specially painted.
Inlet strainers can be removed and cleaned without disconnecting components or pressure piping.
New baffle plate improves fluid circulation.
Easy accessibility to drain plug.

Vickers Custom Built Power Package . . . complete . . . factory pretested . . . ready to connect and operate.

You save time and expense of design, layout, multiple purchasing, and assembly when you buy the Vickers package. You are assured of component compatibility and Vickers undivided responsibility and guarantee for the entire hydraulic package.

A Vickers Custom Built Hydraulic Power Package is a "complete unit" . . . factory pretested, ready for you to connect and operate. Designed and professionally built to your specifications.

Call in a Vickers Application Engineer or write for Bulletin 5001B.



These parts are required to build the Power Package shown above. Purchasing the complete package from Vickers saves you the time and cost of design, assembly, and testing. It also assures the most suitable unit for your particular requirements.

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Machinery Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
Department 1474 • Detroit 32, Michigan

Application Engineering Offices: ATLANTA • CHICAGO* • CINCINNATI • CLEVELAND • DETROIT* • GRAND RAPIDS • HOUSTON • INDIANAPOLIS • LOS ANGELES AREA (El Segundo)* • MILWAUKEE • MINNEAPOLIS • NEW YORK AREA (Springfield, N.J.)* • PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. • ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE* • ST. LOUIS • TULSA • WORCESTER • Factories also in: Australia, England, Japan and Germany • In Canada: Vickers-Sperry of Canada, Ltd., Toronto,* Montreal and Vancouver
Field Service Headquarters Underlined. Whse. Stock & Repair Branches*.

8155

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

Circle **146** *on Time-Saver Card*

NEW PRODUCTS

MECHANICAL SEAL
. . . is dry-running

Designation: Spec. PS-113

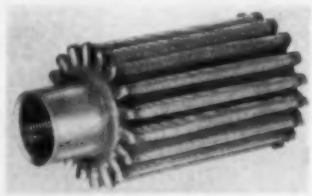
Features: Operates with two specially treated carbon faces running against each other. Minimum heat and friction.

Specifications: Pressure to 150 psi, temperatures to 600 F, surface speeds to 12,000 fpm with lubrication intermittent or none at all.

Sealol Corp.
Providence, R. I.
Circle **317** on Time-Saver Card

SUMP FILTER
. . . has molded end seals

Features: Resulting design based on nationwide study. Molded end seals made from specially formulated plastic. Impervious to all synthetic oils to 300 F. One-piece construction eliminates replacement parts. Exclusive radial fin

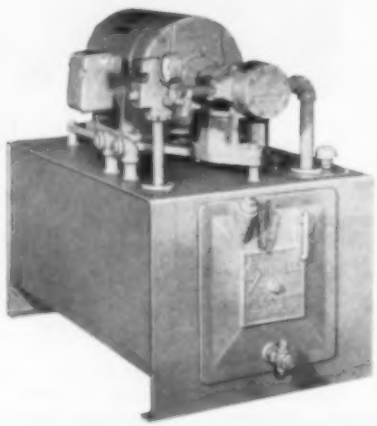


cartridge available in 60 or 100 monel mesh screen.

Specifications: Eight standard sizes. Capacities 5 to 100 gpm.

Dollinger Corp.
Rochester, N. Y.
Circle **318** on Time-Saver Card

CARDWELL STANDARD HYDRAULIC POWER UNIT



SEVERAL HUNDRED POSSIBILITIES! Now, from one Cardwell Catalog, you can specify a "tailored-to-fit" Hydraulic Power Unit from a combination of Cardwell standard parts.

WRITE TODAY for this catalog which describes the new Cardwell Hydraulic Program in detail, including drawings, specifications and price sheets.

DEALERS and DISTRIBUTORS will want this new program, too! One catalog gives you a complete line of Standard Hydraulic Power Units. Write or phone . . .

The CARDWELL MACHINE COMPANY
Franklin at 19th St., Richmond 11, Virginia • Phone Milton 4-4593

Circle **28** on Time-Saver Card

LONG LIFE SOLENOIDS
. . . decrease wear

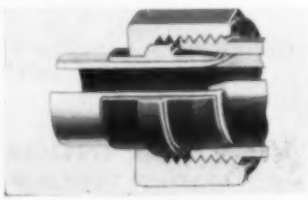
Designation: Long Life

Features: Designed for 100 million or more operations. Utilizes machine tool type bearing as a plunger guide. Decreases wear by precision fit of guide and plunger.

Automatic Switch Co.
Florham Park, N. J.
Circle **319** on Time-Saver Card

TUBE FITTING
. . . is self-flaring

Features: Employs hardened steel sleeve to press the tube into the contoured body to form a flare as



fitting is tightened. This forms a pressure-tight seal on OD and ID

of tube. Excess vibration is absorbed by a slotted skirt on rear of sleeve.

Specifications: Available in sizes ⅛ to 2 inches and all common styles. In steel, stainless steel, brass and aluminum.

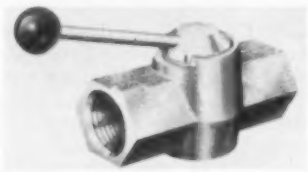
Flodar Corp.
Cleveland, Ohio

Circle **320** on Time-Saver Card

PLUG VALVE
. . . for vacuum to 150 psi

Designation: 9200 Series

Features: Handle-operated. Opens and closes against pressure with



little effort. Use of three O-rings eliminates adjusting nuts and springs. Permits long maintenance-free service life.

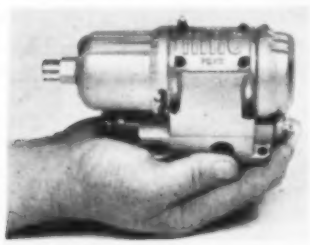
Specifications: Sizes ⅛, ¼, ½, ¾ inch in brass. Stainless steel, ¼ inch.

Circle Seal Products Co.
Pasadena, Calif.

Circle **321** on Time-Saver Card

4-WAY AIR VALVE
. . . is compact

Features: Dual-seal. Direct operation, shorter stroke, fast response. Increased rated capacities by circular-flow design. Only 3 of 11 parts move, reducing fatigue failure and maintenance. Add-a-unit inter-



changeable manifold bases permit grouping of 2 to 10 valves. Utilizes MACsolenoid.

Specifications: One-third size and weight of most ⅜ inch valves. In ¼, ⅜ and ½ inch port sizes.

Mechanical Air Controls, Inc.
Detroit, Mich.

Circle **322** on Time-Saver Card

Continued on next page

Chemiseal®
NYLON PRESSURE TUBING

Offers you more design "leeway"

You can flex it, twist it, bend it. In fact, you can shape CHEMISEAL Nylon Pressure Tubing into practically any contour. Think what this means to you in design freedom and versatility!

A Superior Design Material. CHEMISEAL Nylon Pressure Tubing is unaffected by oils, alkalies, hydraulic fluids, and many solvents that tend to corrode metal. It resists vibrational fatigue, abrasion, impact . . . withstands temperatures from −60° F. to +180° F. (can be heat stabilized for 300° F.) . . . available in 1000 and 2500 psi. grades, conforming to J.I.C. specifications. Diameters from ⅛" O.D. up, depending on customer needs.

Typical applications are hydraulic and pneumatic systems, pressure lubrication lines, oil and fuel lines, vacuum system connections, food and chemical processing lines. Find out how CHEMISEAL Nylon Pressure Tubing can help you; contact one of The Garlock Packing Company's 30 sales offices and warehouses in the U.S. and Canada, or write for Bulletin NPT.

THE GARLOCK PACKING COMPANY,
Palmyra, New York

United States Gasket *Plastics Division of* **GARLOCK**

Circle **141** *on Time-Saver Card*

Circle **9** on Time-Saver Card

free catalog

47-page catalog illustrating complete line of

AIR CYLINDERS, AIR VALVES, AIR CLAMPS, DIAL FEED TABLES

WRITE BEFORE NEXT TUESDAY

ALLENAIR

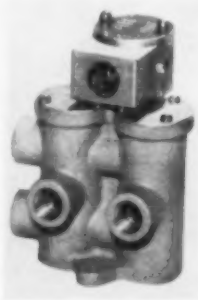
The cylinder of "distinction" shown above is a Factory Reject. Only straight rods available.

ALLENAIR CORP. AH-3
225 East 2nd Street, Mineola, N. Y.
Name .....
Company .....
Address .....
City ..... Zone ..... State .....

NEW PRODUCTS

SOLENOID VALVE
. . . for fast cycling

Features: Still going after 100 million cycles. Water-proof coils have been added to all Crescent 4-way valves. No lag, opens and closes instantly. Continuous operation at



600 cycles per minute. Low power consumption, only 0.5 amps inrush and 0.16 amps holding.

Barksdale Valves
Los Angeles, Calif.
Circle **323** on Time-Saver Card

PRESSURE GAGE
. . . has solid front

Designation: Safe-T-Case Gage

Features: Solid metal front plate forms partition between dial and

tube. Designed to divert burst force backwards, away from operator, escaping by deforming back cover plate. Back plate, which covers entire rear of unit, can be forced open by 3 psi minimum. Plate held by threaded screw as safeguard against sudden high pressure surge.

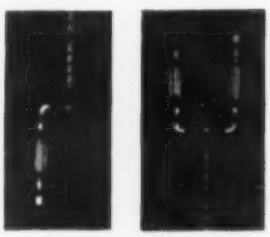
Specifications: Sizes 4½ and 6 inch dials. Can measure pressures up to 20,000 psi to guaranteed accuracy of plus or minus ⅜ of 1% of

new protection for manometers

Chemiquip's
MERCURECEIVER

- Guards against loss of valuable mercury.
- Prevents transmission of surges and pulsations to instrument.
- Assures accurate pressure readings.
- Equilibrium at average pressure in seconds.

Specially designed by the makers of the famous CHEMIQUIP Pressure Snubbers, the MERCURECEIVER holds mercury within the manometer . . . at pressures up to 30 psi. Should the pressure ever exceed 30 psi, mercury is trapped in the MERCURECEIVER. Also acts as a pressure snubber. Operates up to a maximum of 3000 psi on manometers up to 45". Furnished in moly steel with stainless steel end fittings, or in all stainless steel for corrosive conditions.



Mercurecelvers installed on open end of absolute manometer — on both ends of differential manometer

Write today for detailed Mercurecelver Bulletin BW-741

CHEMIQUIP CO. 36 East 10th St. New York 3, N. Y. GRamercy 7-3772

Circle **29** on Time-Saver Card

Are your Airlines LAZY?

. . . THEN USE
TRU-FLATE
QUICK COUPLERS AND NIPPLES

- "More Air" with minimum line turbulance and pressure drop.
- Heavy Duty construction—light in weight—easily repaired—competitively priced.
- Stocked in Sleeve Type series (as illustrated) in sizes ⅛" to 1" or Push Type series in sizes ⅛" to ½".
- Specialty couplers available for oxygen, acetylene, freon, ammonia, oil, steam, and low pressure gas.
- Interchange couplers and nipples, in both Sleeve Type and Push Type for most competitive makes.

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TRU-FLATE® INC.

888 — 92nd AVENUE • OAKLAND 3, CALIFORNIA

Circle **138** on Time-Saver Card

full-scale range. Connections to gage are ¼ inch male NPT up to and including 1000 psi and ⅛ inch male NPT over 1000 psi. A 9/16 inch fitting also available.

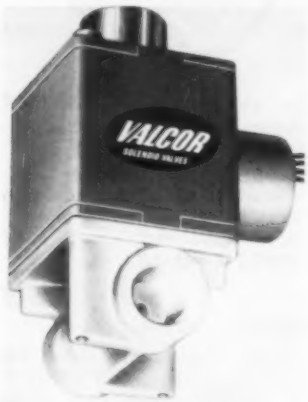
Helicoid Gage Division
American Chain & Cable Co., Inc.
Bridgeport, Conn.

Circle **324** on Time-Saver Card

THREE-WAY VALVE
. . . has nylon seat

Designation: SV-54 Series

Features: Nylon seat and port threads. Needs no compound due



to Dryseal threads. Severe vibration won't loosen. Non-corrosive. Hard chrome-plated plunger good for millions of cycles. Shock-resistant. Made in standard ac and dc voltages.

Valcor Engineering Corp.
Kenilworth, N. J.

Circle **325** on Time-Saver Card

BLOCK PANEL
. . . reduces back piping

Features: Leak-proof mounting pad piping connections. Subplates have pressure, return and drain lines

manifolded vertically within block. Continuous passage from block to block, sealed by O-ring at each interface. Tie-rods placed axially through these fluid passages with terminal fittings that either plug or allow fluid line connections to internal manifold.

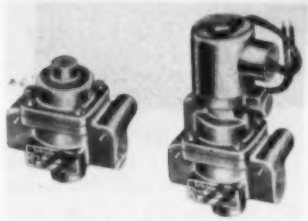
Specifications: Passage area capable of handling 30 gpm of 150 SSU hydraulic oil.

Petch Mfg. Co.
Detroit, Mich.

Circle **326** on Time-Saver Card

THREE-WAY AIR VALVE
. . . pilot or solenoid

Features: Pilot head or solenoid chamber uses same base. Fast conversion made by removing and replacing four cap screws connecting head to base. Easy change from NO to NC. Only four working parts. Valves are easily mounted. Poppet-type design of both valves



permits maximum air passage.

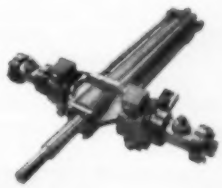
Specifications: From 20 to 150 psi operating pressure. Voltages are

Continued on next page

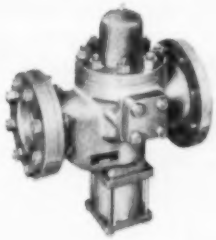
it's Lassman for unusual

HEAVY-DUTY EQUIPMENT

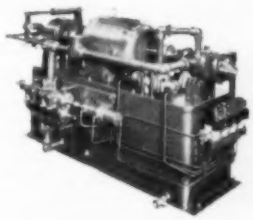
Trunnion Type Hydraulic Cylinders with balanced swivel pipe connections . . . no hoses required. Trunnions, cast integral with head; bronze bushed pedestal bearings furnished. Tie rod or flanged cylinder barrel.



Valves . . . standard or special types like this 8" pilot operated check valve for 5000 psi water service.



Pump Units and complete hydraulic control systems carefully engineered for the specific application.



And we also design and build hydraulically operated machines including car dumpers, hydrostatic testing units, dead weight accumulators and special purpose presses.

Quality EQUIPMENT for *Quality* PERFORMANCE

BENJAMIN LASSMAN & SON Route 8, GLENSHAW, PA.

Circle **84** on Time-Saver Card

NEW PRODUCTS

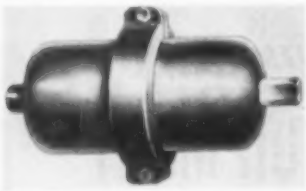
12, 110, 220 and 440. Thread sizes from ¼ to 1 inch on both valves. Pilot valve only 3½ inches high.

A. Schrader's Son
Division of Scovill Mfg. Co.
Brooklyn, N. Y.

Circle **327** *on Time-Saver Card*

TWO-PART ACCUMULATOR
. . . absorbs line shock

Designation: SpeeCo Accumulator



Features: Absorbs line shock, reduces pressure peaks, smooths out pump pulsations. An effective booster in storing hydraulic energy. Easily installed, quick maintenance. Inexpensive rubber barrier ordinarily only repair needed. Streamlined dome-end casting stronger, requires less metal, lighter and less expensive.

Specifications: Sizes 15 to 7500 cu. in. for pressures up to 2000 psi. Higher pressure units and larger sizes made to order.

Special Products Co.
Golden, Colo.

Circle **328** *on Time-Saver Card*

DISPOSABLE ACCUMULATOR
. . . absorbs shock

Designation: Geerolator

Features: Lightweight. Can be installed on present lift trucks and bucket loaders with ease. Helps reduce maintenance and replacement costs. Designed for working pressure of 2000 psi; proof pressure 4000 psi, and burst pressure, 6000 psi. Comes charged with inert nitrogen gas, ICC-approved for shipment.

Specifications: Quart size has 4¾ inch diameter, 11¼ inch length. Gallon size has 6⅝ inch diameter, 15⁹⁄₁₆ inch length.

Greer Hydraulics, Inc.
Jamaica, N. Y.

Circle **329** *on Time-Saver Card*

TIMER MAINSPRING
. . . is unbreakable

Designation: Mark-Time

Features: Uses special steel alloy. Combines strength, corrosive resistence, and long life. Tensile strength exceeds 200,000 psi even

under abnormally hot, cold, and corrosive operating conditions.

M. H. Rhodes, Inc.
Hartford, Conn.

Circle **330** *on Time-Saver Card*

PLUNGER PUMP
. . . is versatile

Designation: TX-10

Features: High output and low cost. Reduces inlet losses which reduce volumetric clearance in its fluid cylinder. Inlet valves flow

AIR-MITE AIR CYLINDERS

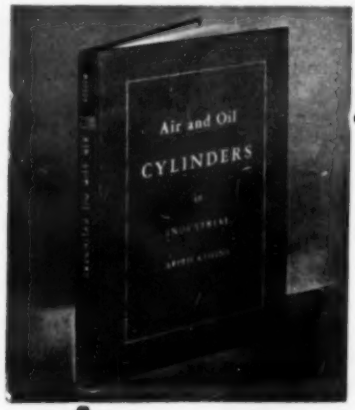
Compact—
Powerful—
Rugged—
Low Cost!

AIR-MITE Cylinders—made in Single or Double Acting Series, in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling, or lifting is required, AIR-MITE Cylinders will meet your most exacting requirements of dependability and long life. Write for complete catalog and prices.

QUALITY FEATURES:
1 Ground and polished steel ram
2 Brass, true-bore cylinders
3 High strength aluminum alloy cylinder heads
4 Bronze oilless ram bushing
5 Five steel tie rods

AIR-MITE DEVICES, INC.
4401 W. Kinzie St., Chicago 24, Ill.

Circle **157** *on Time-Saver Card*



AIR & OIL CYLINDERS

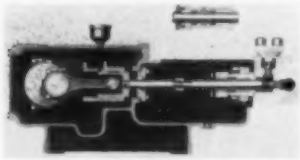
Elmer Heiser has written this valuable cylinder handbook which tells about types, cushions, how to order, proper porting, correct sizing, packings, and efficient installation methods.

It's full of application ideas.

PRICE $5.00

The Industrial Publishing Corporation
812 Huron Road • Cleveland 15, Ohio

directly in line with plungers. Suction and discharge valves are inter-



changeable. Bolted forged steel valve covers. Suction and discharge openings on both sides of cylinder.

Union Steam Pump Co.
Battle Creek, Mich.

Circle **331** *on Time-Saver Card*

LEAKPROOF ACCUMULATOR
. . . uses free piston

Designation: Model 30001

Features: Long seal life with no air or oil leakage. Free piston has three O-ring seals. Air or oil trapped between two given seals is automatically discharged to its respective chamber during each

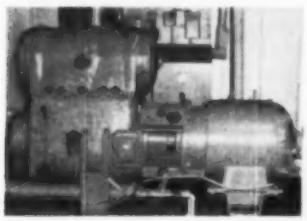
piston stroke. End caps use same O-ring as piston, reducing spare part inventory.

Narda Hydraulics Corp.
Mineola, N. Y.

Circle **332** *on Time-Saver Card*

AIR COMPRESSORS
. . . for 8 to 650 cfm

Designation: Hydrovane Rotary



Features: Wear-resistant rotor blades prevent serious compressor damage. Long, efficient life. Displacement, 8 to 650 cfm. Sizes 2 to 125 hp. Pressures to 125 psi. No exposed belts or couplings. Occupies little space.

Davey Compressor Co.
Kent, Ohio

Circle **333** *on Time-Saver Card*

Continued on next page

all STEEL

New Fulflo all-steel, piston type, oil relief hydraulic bypass valves combine proven features with the advantages of all-steel construction in flange models from 1" to 3".

FULFLO

ALL-STEEL, ALL-BRASS OR OTHER COMBINATIONS FOR POSITIVE AUTOMATIC PRESSURE CONTROL YOU CAN DEPEND UPON AT ALL TIMES

all BRASS

Fulflo Valves feature shear-closing action for quiet, non-chattering operation. They offer greatest safety, matched to job conditions. Priced right for O.E.M. use . . . built right for superior replacement service.

• Standard and flanged models • Just 6 springs for pressures to 500# • Steel, cast iron or brass bodies • Brass, steel or stainless pistons • Pipe sizes to 3"
• **Specials** to your requirements

COMPLETE CATALOG FREE ON REQUEST

THE FULFLO SPECIALTIES CO., INC.
415 Fancy Avenue, Blanchester, Ohio

FULFLO

Circle **55** *on Time-Saver Card*

NEW PRODUCTS

AIR FILTER
. . . contains Micro-Pak

Designation: Super-Kleen

Features: Removes contamination to five microns from compressed air systems. includes Micro-Pak, a highly-absorbent disposable textile cartridge. Cartridges easily replaced. Handles volumes of air to 150 cfm at 100 psi with minimum pressure drop.

Specifications: Sizes from ¼ to 1 inch NPT. Pressures to 250 psi.

Wilkerson Corp.
Englewood, Calif.

Circle **334** *on Time-Saver Card*

RELIEF VALVE
. . . with manual control

Features: Pilot-operated relief valve has knob for instant changes in pressure settings. Claims work output boost of more than 35% over "brute force" types due to minimum pressure drop and instantaneous response when reaching peak load.

Specifications: Capacities of 0 to 20 gpm or 0 to 60 gpm. Knob-changed pressure settings from 500 to 2000 psi.

Webster Electric Co.
Racine, Wis.

Circle **335** *on Time-Saver Card*

FLOW RATE TRANSDUCER
. . . for low flows

Designation: Mark X

Features: Translates fluid flows below 1 gpm into linear electrical signal. Used for laboratory evaluation of hydraulic system components. Two units connected back-to-back, for bi-directional measurements without valving. All parts exposed to fluid are stainless steel.

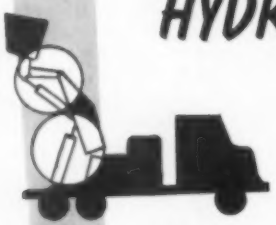
Specifications: Working pressure, 3500 psi, higher on order. Pressure drop is 2 psi. Maximum fluid temperature is 250 F, higher on order. Senses flow to .002 gpm. Output is 0-100 millivolts.

Ramapo Instrument Co.
Bloomingdale, N. J.

Circle **336** *on Time-Saver Card*

ON THE JOB...

with CROSS HYDRAULIC CYLINDERS



Stay "on the job" with dependable, rugged Cross Hydraulic Cylinders. Like Cross customers everywhere, you too, will appreciate the fast, courteous, dependable service you get from Cross. Phone for speedy delivery on any quantity...quality-built to your specifications. Contact Cross Engineering Department, today!

- RUGGED
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CUSTOM DESIGNED CYLINDERS FOR EVERY APPLICATION

Try CROSS CYLINDERS in your operation... low cost, dependable, and trouble free.

Lowest-Priced Engineered Quality Cylinders Available..

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CROSS MANUFACTURING CO.
LEWIS, KANSAS – PHONE EA 4-5525

WRITE • WIRE • PHONE...TODAY!!

Circle **37** *on Time-Saver Card*

AIR REGULATORS
. . . in two sizes

Designation: Controlled-Air-Power

Features: Built-in pressure relief valve allows increases in downstream pressure to bleed to atmosphere when setting is exceeded. Regulator knob turns on one plane of rotation, eliminating thread action which extends unit height.

Specifications: For line pressures to 250 psi. Maintain downstream

pressure of 0 to 50 psi, 0 to 125 psi, 0 to 250 psi on separate units. Wall or panel mounting brackets. Gauges optional. Sizes ¼ and ⅜ inch.

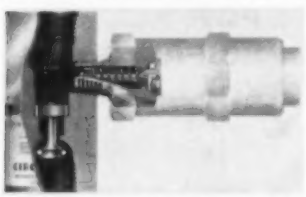
The Bellows Co.
Akron, Ohio

Circle **337** *on Time-Saver Card*

GAUGE PROTECTOR
. . . has positive shutoff

Designation: 1100 Series

Features: Protects from over-pres-



sure. For actuation from 5-2400 psi. Use of contact seals insures precise operation at very low settings. Automatic cut-out and cut-in provided. Permits wide range of accurate pressure readings.

Circle Seal Products Co., Inc.
Pasadena, Calif.

Circle **338** *on Time-Saver Card*

SYNTHETIC COMPOUND
. . . used in O-rings

Designation: No. 75-148

Features: O-rings made of high-strength silicone compound suited for oil temperatures to —100 F.

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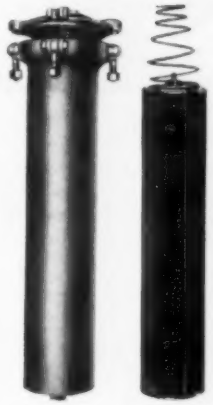
NUGENT
FILTERS • STRAINERS
LUBRICATION SPECIALTIES



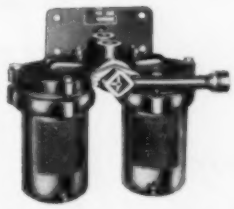


Fig. 1555BF Duplex Filter uses factory packaged laminated fiber disc filtering elements. Each filter comprising duplex operates independently or in parallel. Wide range of sizes.

Fig. 1576 Bag-Type Pressure Filters feature inexpensive, completely disposable filter cartridges. For filtering fuel oil, lubricating oil and wide variety of fluids.

AT LEFT: Fig. 1555-4L Filter and laminated disc cartridge. High flow rate; low pressure drop. Excellent micronic efficiency. Cartridges interchangeable with all other Nugent Bag or Depth Type cartridges.

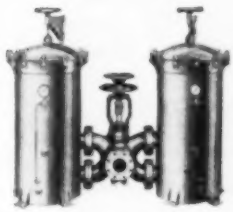


Fig. 1554AN-4L7 Duplex Strainers provide the advantage of uninterrupted flow, without by-passing, while cleaning the strainer baskets. Each strainer comprising duplex uses 7 strainer baskets Fig. 1554A-4L.

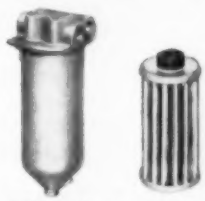


Fig. 1490AM-0 star-shaped extended area strainers offer increased free screen area over round basket type.

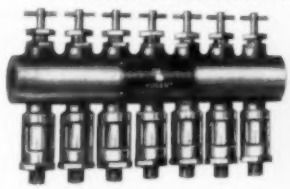


Fig. 1503F Multiple Pressure Oilers are available with from 2 to 24 feeds.

Fig. 524 Sight Feed Valves with removable glass. ¼" to ¾" IPS.

Fig. 1575 Pressure Sight Flow Lubricator. Single units or multiples to 15.

Fig. 1366E Sight Flow Fittings for indicating flow of liquid in a pipe line. Available in brass, cast iron, steel or stainless steel.

Valuable equipment deserves the best possible protection that can be provided. Nugent offers a complete line of filters, strainers and lubrication specialties for this purpose. All are backed by the experience and know-how gained through solving industry's problems in this field for more than 60 years. For bulletins giving complete information on any or all Nugent products, call or write today.

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. . . have sectional construction

Features: For industrial and agricultural use. Can be stacked up to 6 sections. Operating pressure 2000 psi, shock pressure 5000 psi. Made in 20 and 40 gpm size. Check valve in each section. High tensil iron body. Balanced spools. Throttling notches for smooth application of power. Choice of detents, spring centering, or spring offset.

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Single or 2-spool VALVE

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PARALLEL VALVE
for heavy duty industrial mobile hydraulic applications

Capacity: **40 GPM** at 20 ft./sec.
MAX. PRESSURE: 1500 PSI

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CARTRIDGE type relief valve has hardened seat.
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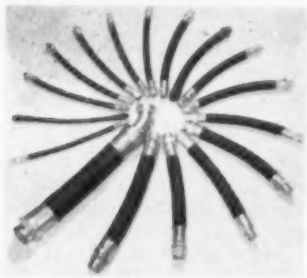
braid, and spiral reinforced hose for all pressures. Perforated cover hose for gas-conducting service.

Specifications: Male pipe, swivel male pipe, 37° and 45° flare and swivel nut, and straight threads



for SAE O-ring boss. Straight and angle 4-bolt split flange end connections.

Parker Fittings & Hose Division
Parker-Hannifin Corp
Cleveland, Ohio

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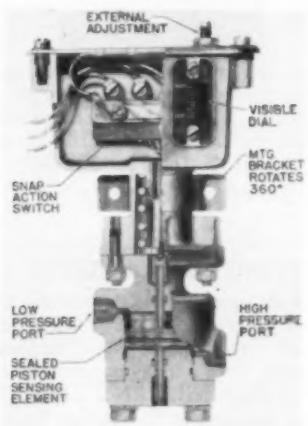
PRESSURE SWITCH
. . . senses psi difference

Features: Suitable for filter installation, switch senses difference from 5 to 140 psi between two pressures across filter inlet and outlet and actuates a warning circuit. Can be used on oil systems from 50 to



6000 psi working pressure. Proof pressure of 9000 psi gives protection against damage from sudden surges and shock loads. Simple field setting by external adjustment screw and visible dial.

Specifications: Fixed actuation value of switch is 5 to 15 psi, depending on system pressure.

Barksdale Valves
Los Angeles, Calif.

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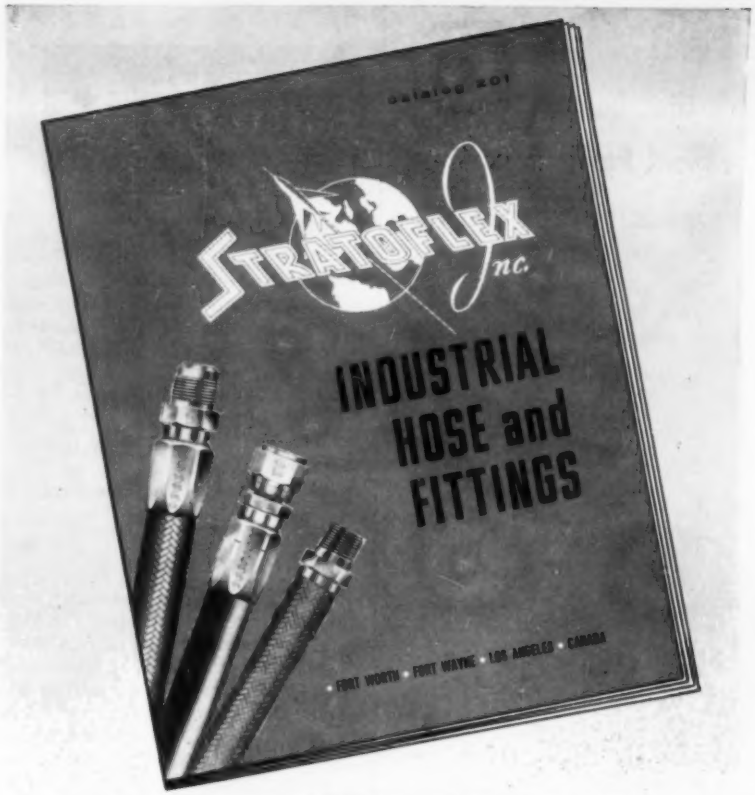

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USEFUL LITERATURE

FORGED COUPLETS

For branch connections to pipelines, tanks and pressure vessels. Screw-end and socket-welding end connections in sizes ¼ to 2 inches. Pressures to 3000 psi. Easily installed or modified by torch contouring. Four page Bulletin CP-1-58 includes dimension and weight tables. *H. K. Porter Co., Roselle, N. J.*

Circle **411** on Time-Saver Card

REDUCING VALVE

Fig. 1910, Type E, designed for initial presures to 300 psi with gas, oil or water. Outlet or regulated spring ranges are 5-35, 20-60 and 40-90 psi. Has reverse seating arrangement to operate as relief valve (1910-R). Two-color sheet includes features, description, operating information, valve drawing, dimensions and parts list. *Atlas Valve Co., Newark, N. J.*

Circle **412** on Time-Saver Card

SERVO PRESET UNIT

Set manually, bracket assembly accommodates single or dual potentiometers. Provides electrohydraulic servo systems with higher electrical performance. Gives longer component service. Four-page Bulletin 36300 gives specifications, dimensions and installation instructions. *Servocontrol, Division of Oilgear Co., Milwaukee, Wis.*

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AIR DRYER

Dries and cleans compressed air. Standard models to vessel capacities of 8000 scfm and 6000 psig. All models inspected, registered. Dewpoint, operating capacities and sizing graphs. Specification tables and model cutaway diagrams. Uses illustrated. *Van Products Co., Erie, Pa.*

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SHAFT SEALS

Stops leakage from pump rotating shafts, compressors, mixers. Eliminates adjusting, repacking. Descriptions, data and specifications for mechanical shaft seals from ¼ to 3 15/16 inch diameters. Details complete line of custom-built Roll Neck Seals. Four pages. *Syntron Co., Homer City, Pa.*

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FLOW DIVIDER

Operates as pair of pressure compensated flow regulators to keep pressure drop equal across two cylinder openings. Low cost for usage where equality of flow within 10% is satisfactory. Also combines flows. Dimensional drawings and cutaway illustration. *Fluid Controls, Inc., Mentor, Ohio.*

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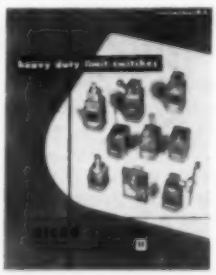
LIMIT SWITCHES

Details of three types of heavy-duty limit switches. Catalog aids plant engineer, maintenance man



and original equipment designer. Lists for either ac or dc. Several actuator designs in each switch type. Catalog No. 84. 16 pages. *Micro Switch, Freeport, Ill.*

Circle **417** on Time-Saver Card

FITTINGS & FLANGES

Catalogs, by size, dimensional and physical data of welding fittings and forged steel flanges. Tables for 2-inch nominal pipe size. Product lists. No. FDC-257. *The Babcock & Wilcox Co., Tubular Products Div., Milwaukee, Wis.*

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Solves low-pressure sealing problems where piping passes through panels up to 14 ga. (.074) thick. Needs no adhesive, snaps into place. Accommodates off-center

Continued on page 148

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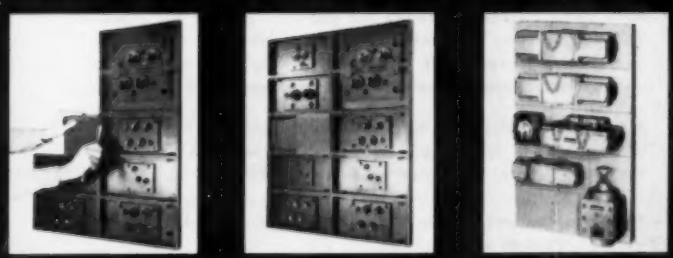

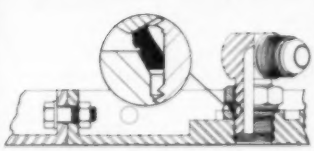

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Complete information, plus how 'Pan-Sec' can be used with manifolds. Write today!

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Representatives in all principal areas

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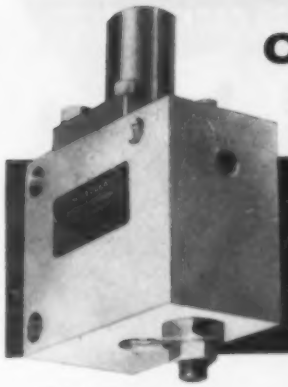

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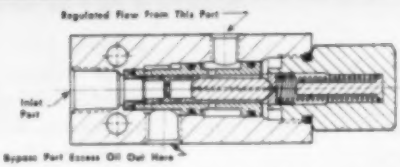
FLOW REGULATOR

(By-Pass & Restrictor Type)
With Built-In Relief Valve

- Fully pressure compensated
- Can replace pump by providing primary flow for power steering, feed and lubricating circuits.
- By-pass flow useable for secondary circuit.

Write for detailed information.



Typical working parts — Relief Valve is in regulated flow circuit.

- For oil to 3000 psi • Pipe Sizes - ¼" to 1"
- Relief valve adjustable in 4 ranges: 0 to 600, 100 to 800, 250 to 1500 and 100 to 300 psi.

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USEFUL LITERATURE

piping. For temperatures —25 to 250 F. Specifications and prices. *LMR Engineering Corp., St. Louis, Mo.*

Circle **419** on Time-Saver Card

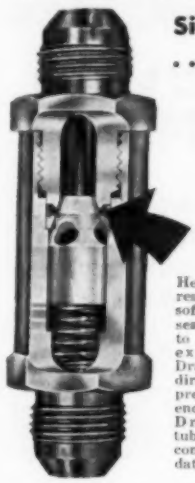
MAGNETIC STARTERS

NEMA sizes 0 through 4 for both reversing and non-reversing single phase and squirrel cage motors. Describes magnet coils, overload relays, contact assembly, enclosure types. Ratings, dimensions, photos. Booklet EN-150, 15 pages. *Cutler-Hammer Inc., Milwaukee, Wis.*

Circle **420** on Time-Saver Card

SILICONE PRODUCTS

Describes multi uses of silicone, including silastics. Used as raw material for O-rings, seals, gaskets, hoses and other mechanical rubber parts. Stocks show only 10 to 20%



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Here's the secret . . . responsive action of the soft, long-lasting O-ring seal! Instantly compresses to seal internal and external pressures. Draws harmlessly around dirt particles. No costly precision parts or extra end seals. Six standard Dryseal pipe and JIC tube sizes; 12 connection combinations. Send for data sheet.

KEPNER PRODUCTS COMPANY
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Kep-seal

HYDRAULIC & PNEUMATIC
CHECK VALVES

* PATENT APPLIED FOR

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compression set after 22 hours at 300 F. Silastic LS-53 bulletin lists typical properties. Tables of chemical resistance to many fluids. *Dow Corning Corp., Midland, Mich.*

Circle **421** on Time-Saver Card

GLOBE VALVES

Overcomes problems of ever-increasing temperatures, pressures and corrosion. Lists material and dimension specifications, pressure-temperature ratings. Sizes ¼, ⅜, ½, ¾, 1, 1¼, 1½ and 2 inches. Pneumatic testings at 300 psi can be specified. Bulletin DH-213. *R-P & C Valve Division, American Chain & Cable Co., Inc., Bridgeport, Conn.*

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DISOGRIN

A solid polyurethane material displacing metal, ceramics, rubber. Supplied in finished parts or components. Gives tensile and tear strength, hardness, resilience, elongation, thermal and high-temperature properties, flex characteristics, abrasive resistance. Bar graphs compare to rubber, nylon, butyl, neoprene. Tables list physical, electrical properties. Uses including packings are illustrated. *Disogrin Industries, Mt. Vernon, N. Y.*

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FLUID LINE CLAMP PLIERS

Secures bolt while clamp is mechanically closed and locked in place. Proper closure insured, preventing misalignment. Hands free to apply nut or other clamps. Standard #8 or 10 size bolts. Illustrates use. Model No. 82. *TA Mfg. Co., Los Angeles, Calif.*

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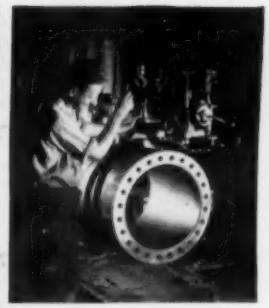
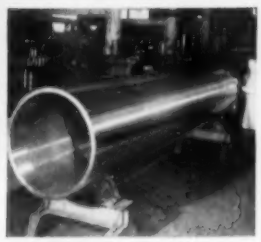
MOTOR SELECTOR

Concise data to users of ac motors from one through 200 hp. Includes brief explanations of NEMA design classes, speed-frequency relationship, current and torque values. Also frame selection tables, complete dimensions for standard frames, and mechanical modifications for frame sizes from 182 to 6085. Photos show special-purpose motors for use in unusual temperatures or atmospheres. Bulletin B-2103-4. Twelve pages. *Reliance Electric and Engineering Co., Cleveland, Ohio.*

Circle **425** on Time-Saver Card





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Even under the severest hydraulic service, you'll always get peak performance from Shenango centrifugally-cast components. They have a uniform, *pressure-dense* grain which makes for unusual strength and wearability. They are remarkably free from inclusions and porosity. And you'll find a *minimum* of machining is needed to attain a *maximum* of finish.

Shenango offers you cylinders and all symmetrical components in a wide range of sizes, shapes and dimensions . . . in most any non-ferrous metal or tough Meehanite metal . . . and rough-machined *or* finished to your exact specifications.

Shenango also offers a broad range of centrifugally-cast tubular bar stock to meet standard *and* specialized requirements.

For the full story on Shenango's modern centrifugal casting process and products, write to: *Centrifugally Cast Products Division,* The Shenango Furnace Company, Dover, Ohio.

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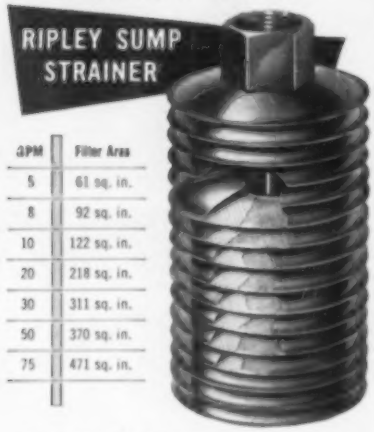
COPPER, TIN, LEAD, ZINC BRONZES • ALUMINUM AND MANGANESE BRONZES
MONEL METAL • NI-RESIST • MEEHANITE® METAL • ALLOY IRONS

Circle **127** on Time-Saver Card

New Disc Design
GIVES YOU GREATER FILTERING AREA!



GPM	Filter Area
5	61 sq. in.
8	92 sq. in.
10	122 sq. in.
20	218 sq. in.
30	311 sq. in.
50	370 sq. in.
75	471 sq. in.

You'll find Ripley Strainers provide long, low-cost, trouble-free protection for your hydraulic equipment. Their self-cleansing discs have no crevices to clog or reduce flow—are assembled in standard combinations to give you *maximum* filtering area in *any* rated size! Available in sump and line models to meet your exact requirements. Send for complete information today!

GPM	Filter Area
5	61 sq. in.
8	92 sq. in.
10	122 sq. in.
20	218 sq. in.

35 years of experience in the manufacture of screens and strainers.

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Filter Division
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Gentlemen: Please send me complete information on your new disc type Sump and Line Strainers.
☐ Name of nearest stocking distributor.
Name_____
Title_____
Company_____
Address_____
City_____ Zone_____ State_____

Circle **119** *on Time-Saver Card*

Are you using a fire-resistant fluid, or thinking about it? To help you pick the right fluid and to be reasonably happy ever after, here's a . . .

Checklist for fire-resistant

• BY JOHN J. PIPPENGER, *Double A Products Co., Manchester, Mich.*

Every use of fire-resistant fluid has its own peculiarities. Many answers on what to do must come from fluid, component, and packing manufacturers. So you won't forget to ask, the checklist includes the important questions. It also covers well-established design, construction, and operating procedures.

SAFETY

1. Does the fluid offer fire protection without the danger of causing an almost equally serious failure of the equipment?
2. Will the fluids have any toxic effects?
3. Can spilled fluid harm employees or their clothing?

FLUID COMPATIBILITY

1. Mixing the fire-restant fluid with other fluids is probably bad. Make certain that filler pipes and storage containers are plainly marked with the name of the fluid.
2. Be certain that all old fluid is removed before filling a system with a fire-resistant fluid.
3. Water may change fire-resistant fluid properties. Check this point and do whatever is necessary to prevent this happening by leakage, spilling, or condensation.

SEALS AND SEALING

1. Will any of the metals in the system be harmed by the fluid and cause metal-to-metal seals to leak?
2. What will the fluid do to static and dynamic seals? Should seal compound or gland design be changed?
3. Drains to catch fluid from leaking seals will save fluid and possibly prevent harm to workers.
4. Be sure replacement seals are made of the right compound.
5. Sealing compounds may cause sludging or breakdown of the fluid. Be sure not to get them in the system.

SURFACE FINISHES

1. Paints, varnishes, other finishes may cause sludging or fluid breakdown. Be sure the fluid cannot touch them.
2. Paint removing ability

fluids

of fire-resistant fluids may cause shorts in solenoids and other electrical components. Watch for leaks in these places. Don't spill fluid on them.

3. Better surface finishes may be needed on gasketed surfaces. Some fire-resistant fluids are good leakers.

FLUID PROPERTIES

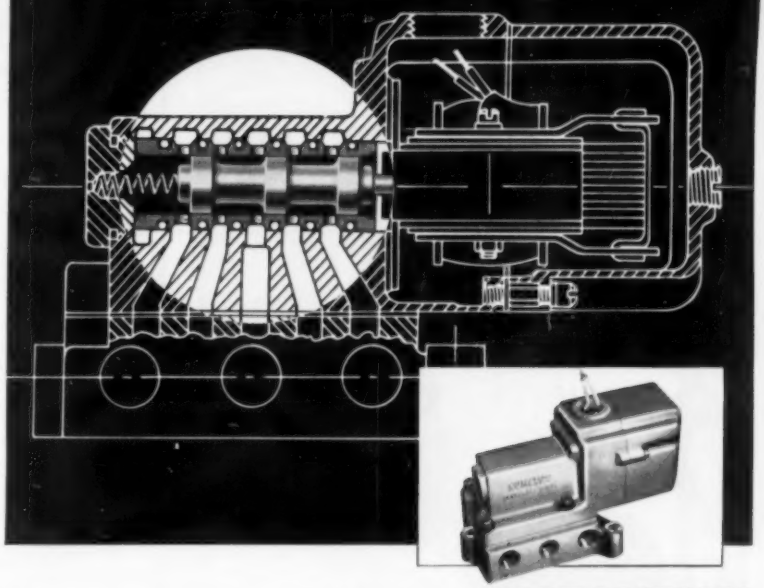
1. How are fluid antifoam properties? Better tank baffling may be needed to reduce foaming.
2. How do lubricity, film strength, pressure stability, viscosity index, and maximum operating temperature compare with what's being used. Operating life may be shorter. Better control of fluid temperature may be needed.
3. Are antioxidation properties good? Parts not always immersed in the fluid may rust or corrode.
4. Errosion rates may be faster with fire-resistant fluids. Check components now and then for this. □□□

Reprints of these articles on fire-resistant fluids are available:

AQUEOUS BASE TYPES
W. H. Millett

PHOSPHATE ESTER BASE TYPES
F. H. Langenfeld

It's the air valve with the floating sleeve-lapped spool design



Starts every time— INSTANTLY!

no sticking, lubrication or dirt problems

Familiar with those Monday morning epidemics of sticking valves? Never happens with Numatics air valves . . . not even after *months* of idleness. Because the patented floating sleeve-lapped spool design eliminates the major cause of sticking . . . moving elastic seals. Sealing is accomplished, instead, by the precision finish and close tolerance between spool and sleeve.

And no-stick, no-leak sealing is just one advantage of Numatics valves. Lubrication is no problem, for a Numatics valve is impervious to oil additives. They'll operate on *any* standard lubricant . . . or, they'll run dry if the application requires it. Dirt is no problem, either, because the file hard, razor sharp spool lands and orifice edges chop dirt particles to a fineness that permits passage through the valve without the slightest damage. What's it all add up to? . . . a valve that's more *reliable* and trouble-free, a valve that will last longer than any air valve now available. For complete details send for your copy of catalog #158.

NUMATICS leads the way in manifolds too

For greater efficiency, lower cost, streamline your valve installations with Numatics multiple mount manifolds. Three types available . . . individual or common exhaust and conduit . . . in 2 to 6 stations, 4 pipe sizes. SA Valves mount interchangeably, too!

NUMATICS, Inc. HIGHLAND, MICHIGAN

SALES REPRESENTATIVES FROM COAST TO COAST

Circle **158** *on Time-Saver Card*

Eliminate human failure! Use the

WILKERSON ***WILK-O-MATIC***

Self-draining

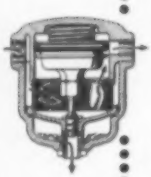
available in combos

MOISTURE SEPARATOR AND FILTER

Used as original equipment by leading pneumatic manufacturers.

- Lowest priced
- No diaphragms
- Most widely used
- First on the market
- Tested to cycle over 3 million times without failure

WHEN AIR IS USED



filter automatically drains its sump. No moisture accumulates, which eliminates danger of water re-entering air stream. Since visual inspection is unnecessary, there is no plastic bowl to break and no drain line is needed.

WHEN AIR FLOW STOPS

moisture collected in filter's upper chamber is dropped to its sump. Unit is then in position to drain itself. Less air is wasted than with manual drain units.

Extend the life of your machines and tools by removing moisture, and contaminants

- Requires less space than manual type
- No plastic bowl to break
- 10-300 PSI operating range
- Up to 55 CFM—Low pressure drop
- Removes solids as small as 5 microns
- Easily serviced and maintained

WRITE for detailed information on the WILK-O-MATIC and other Wilkerson products.

Find It Fast In The 'Yellow Pages'

WILKERSON CORPORATION THE LEADING LINE OF AIR LINE PRODUCTS

"Dedicated to keeping the NEW in pNEUmatics" 1643 West Girard, Englewood, Colo.

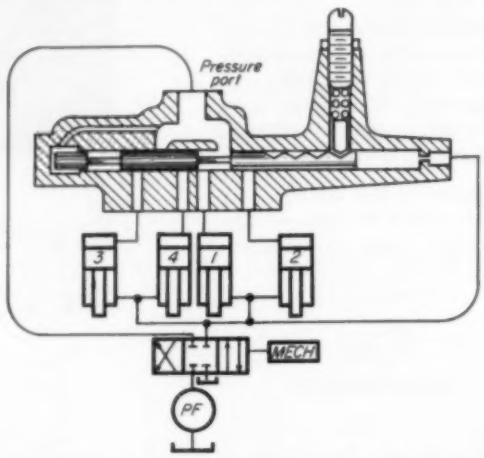
Circle **154** on Time-Saver Card

FLUID POWER PATENTS

CYLINDER SEQUENCING VALVE

Valve progressively actuates hydraulic cylinders in a preset sequence. It is automatically shifted from one cylinder to another by differential pressures in cylinder supply and return lines. When one cylinder has been actuated to its limit, valve shifts and moves the next cylinder in the same direction.

To extend cylinders, 4-way valve is shifted to direct pump flow to the sequence valve. With the spool



in the position shown, oil passes through the valve to extend cylinder 1. When cylinder 1 is fully extended, pressure build-up acting on the left side of valve spool moves it to the right. Since flow of oil into the enlarged portion of valve body left of the spool is slow, movement of the spool is also relatively slow. When spool opens port to cylinder 2, pressure at the left drops, and detent holds spool. Cylinders 3 & 4 will extend in the same manner.

To progressively retract cylinders, the 4-way valve is shifted, and system pressure is applied to the rod end of the cylinders and the right side of the sequence valve. As spool moves to the right it connects the blind end of cylinders 4, 3, 2, and 1 to tank in that order.

U. S. Patent 2,844,942, Eugene R. Reynolds, McAllen, Texas.

HYDRAULIC FORCE LIMITER

Limits the force a pilot can apply to aircraft control surfaces, but permits him to override the limiting force in an emergency.

During normal operation of the aircraft, valve spool is in neutral position, allowing a small leakage from the supply line. The piston-return spring applies

Continued on page 104

Circle **139** on *Time-Saver Card*

Saves hours in piping installations

PAT. PENDING

Eliminates leaks in oil, air, water, vacuum, chemical lines

Tru-Seal saves hours in assembling piping installations because it enables you to run your pipe lines in any direction you wish, quickly and easily—without having to recut and re-thread piping sections. Wherever used on air, oil, water, steam, vacuum or chemical lines, it seals perfectly at —100° F. to plus 500° F.—*without the use of pipe dope.* Its installation requires only light tightening torque, thus eliminating over-tightening damage to valves, pumps, compressors, and other fittings.

For further information write

TRU-SEAL DIVISION
FLICK-REEDY CORPORATION
2008 N. Hawthorne, Melrose Park, Ill.

"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.

1
Thread Tru-Seal on pipe or fitting as far as it will go hand tight.
SEAL SIDE
2
Thread pipe or fitting 3 threads into part. Point in desired direction.
3
Tighten Tru-Seal to complete leakproof assembly (only light torque required).

Shown above is 3000-cfm VAN-AIR Dryer—the type used by steel, automotive, chemical, container and other plants. Installed in compressor room it purifies and delivers clean, dry air to plant-wide operations. Many other capacities (see below) are also available in the complete line of VAN-AIR

COMPRESSED AIR DRYERS

THAT OPERATE FOR LESS THAN ¢-CENT PER 6000 CU.FT.

The VAN-AIR Dryer is automatic. It purifies raw compressed air through a triple-action desiccator that extracts water and dirt—then reduces moisture to zero-dewpoint. It entails no heat, regeneration, volume loss or carry-over—under 1% pressure drop. The clean, dry, "instrument" quality of Van-treated air is indispensable for air controls, tools, processes, etc. as a guard against corrosion, pollution, dilution, freezing, etc.

23 STANDARD CAPACITIES—
25 to 3000 cfm
30 to 6000 psi
PATS. PEND.

Van-Air DRYER

PLANT ENGINEERS! With an eye to efficiency (cost saving, too) look into advantages of dry compressed air. Ask for brochure with dewpoint graphs.

VAN PRODUCTS CO. ★ Engineers ★ Manufacturers

5713 SWANVILLE ROAD, ERIE, PENNSYLVANIA

Circle **142** on *Time-Saver Card*

New Miniature SOLENOID VALVES

Allied Control's Stainless Steel Solenoid Valve

*

Available in two- and three-way normally open and closed types, this new line of solenoid valves has a pressure range from 0 to 400 psi.

OUTSTANDING FEATURES:

- Body and all internal parts corrosion resistant stainless steel.
- Soft synthetic plunger insert to prevent leakage.
- Spring loaded plunger permits valve to be used in any position.
- Leakproof welded joints.
- Coils available for practically any voltage requirement.
- Coil housing—steel with heavy bright cadmium plating.
- Can be serviced without removal from media lines.
- Ingenious magnetic structure permits greater media flow and higher pressure ratings than comparable size valves.
- Small in size (1½" x 2¼")—large in capacity.
- Packless—only 2 moving parts.

* FOR MORE INFORMATION WRITE FOR BULLETIN V.

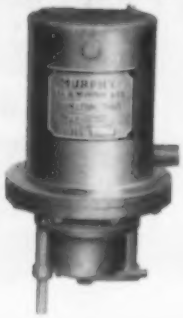
ALLIED CONTROL VALVE DIVISION
ALLIED CONTROL COMPANY, INC.
2 EAST END AVENUE, NEW YORK 21, N. Y.

AL-188

Circle **10** on *Time-Saver Card*

Circle **101** on Time-Saver Card

the 2569
MURPHY



SEPARATOR
does a smooth job of
SEPARATING and EJECTING
water, oil, scale, and rust from
COMPRESSED AIR LINES
YOU SHOULD HAVE FULL INFORMATION
Write now for FREE Data Sheet No. 2569
JAMCO
JAS. A. MURPHY & CO., INC.
1417 EAST HIGH STREET, HAMILTON, OHIO

Modernair
NEW ¼" SOLENOID VALVE

for Air or Oil Hydraulic Service, 30 to 150 p.s.i.

★ **ULTRA COMPACT...only 4-9/16" long, 3-5/16" high, 1-3/4" wide overall!**
★ **NON-CORROSIVE CONSTRUCTION...brass and aluminum throughout.**
★ **"O" RING SEALS...replaceable without disturbing piping.**
★ **AVAILABLE IN SINGLE OR DOUBLE SOLENOID for all popular a.c. or d.c. voltages.**
★ **3-WAY (3 port) OR 4-Way (5-port) MODELS, with or without exhaust speed control valves as shown. Standard ports are female 1/4" NPT.**

MODERNAIR's new BV Series ¼" solenoids put the answer to scores of fluid power control problems literally in the palm of your hand. Why not get the facts now? Write or wire for specifications, prices.

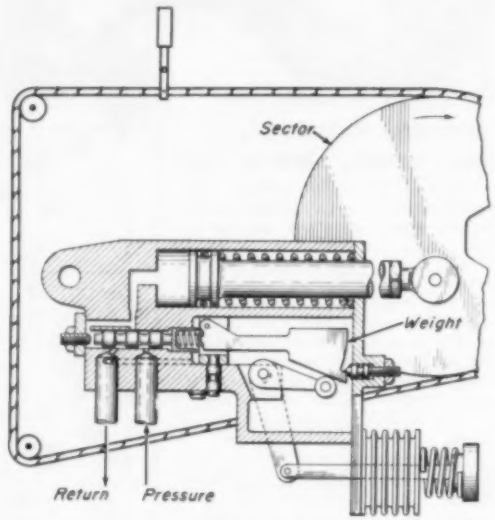
Modernair CORPORATION
Dept. B3 400 PREDA ST., SAN LEANDRO, CALIF.
Member National Fluid Power Association 20

Circle **100** on Time-Saver Card

FLUID POWER PATENTS

an equal and opposite pressure to the piston to balance the pressure caused by leakage.

When the aircraft is subjected to an excessive "g" load, spring-loaded weight moves down. Valve spool is moved to the left and fluid under pressure enters the cylinder. Increased pressure on the piston is transmitted to the sector, adding resistance to the pilot's



stick movement. When the "g" load becomes normal, the spring returns the weight to its normal position.

The pilot can override the force limiter by using an abnormally large force on the controls. This force causes pressure to build up on the piston and on the left side of the spool. The spool moves to the right relieving pressure in the piston chamber. The force limiter remains inactive as long as the pilot holds enough force on the controls to keep the spool valve in the vented position.

U. S. Patent No. 2,849,198, Otto J. Borngesser, Hermosa Beach, Calif. Assigned to U. S. Navy

Other Patents Issued

TRACER CONTROL VALVE
No. 2,848,202, by Arthur P. Waterson, assigned to Le Blond Machine Tool Co., Cincinnati, Ohio.

REDUCING RELIEF VALVE SQUEAL
No. 2,858,805, by Clovis W. Lincoln, Wayne H. Watling, and William Blair Thompson, Assigned to General Motors Corp., Detroit, Mich.

PRESSURE RESPONSIVE VALVE
No. 2,855,947, by Norman Lee, assigned to The Keelavite Company Ltd., Coventry, England.

HYDRAULIC LOCKING CYLINDER
No. 2,861,549, by Cornelius A. Gardener, assigned to Lockheed Aircraft Corp., Burbank, Calif.

RECIPROCATING CYLINDER
No. 2,861,551, by Charles Gordon Simons, Bridge of Allan, Scotland.

MULTI-POSITION CONTROL VALVE
No. 2,858,849, by Leonard F. Griffith, Assigned to General Controls Co., Glendale, Calif.

Circle 7 on Time-Saver Card

NEW SILENCER
for air exhausts

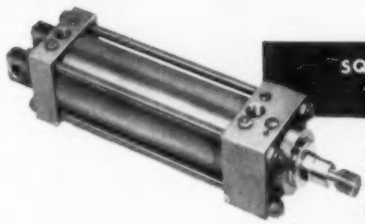
High noise levels are effectively reduced by a new silencer developed by Air-Maze Corporation. Fits directly to exhaust ports or piping. Breaks up shock waves to attenuate objectionable noise without noticeably impairing efficiency of air operated equipment.

Standard sizes for ⅛"- ¼"- ⅜"- ½"- ¾" pipe sizes.

Write for details in Bulletin KK-657, **THE AIR-MAZE CORPORATION**, Cleveland 28, Ohio. Department AH-3

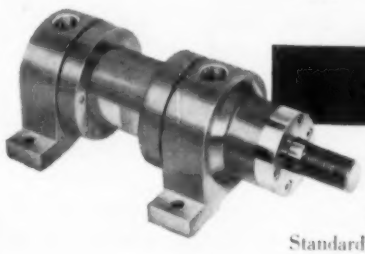
Circle 130 on Time-Saver Card

for that
BIG PUSH
LINDBERG HAS THE RIGHT CYLINDER



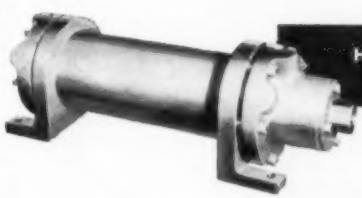
SQUAREHEAD "S" LINE

A feature packed line with the "quick change" feature • Rated 250 psi for air, up to 1000 psi hydraulic • 7 bore sizes thru 6" • Standardized mounting dimensions.
WRITE FOR BULLETIN S-101



2000 PSI "H" LINE

An extra heavy duty hydraulic cylinder • Available with or without cushions • Standard or 2:1 rods • Bore sizes through 8 inches in 5 mounting styles.
WRITE FOR BULLETIN H-101



HEAVY DUTY "A" LINE

A rugged non-tie rod cylinder for air pressures up to 150 psi and low pressure hydraulic service. Bore sizes through 12 inches • Cushions optional • 5 mounting styles.
WRITE FOR BULLETIN A-101

OTHER CYLINDERS
For fast action on mill type cylinders or specials designed to suit your exact needs, send outline of your requirements to our factory.

MEMBER N.F.P.A.

LINDBERG AIR and HYDRAULIC DIV.
TEER, WICKWIRE & CO.
1802 WILDWOOD AVE., JACKSON, MICHIGAN

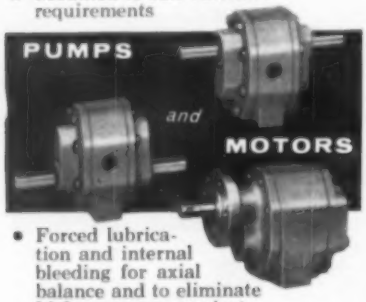
Circle 134 on Time-Saver Card

Precision Engineered Hydraulic Equipment

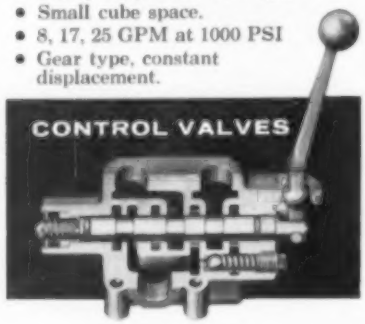
. . . by the World's Largest Builders of Hydraulic Jacks . . .

NEW, LOW COST MANUAL HYDRAULIC PUMP FOR AGRICULTURAL OR LIGHT INDUSTRIAL EQUIPMENT

- ★ Stroke 2⅜"
- ★ Maximum Operating Pressure 1500 PSI
- ★ Fluid Capacity .966 gallon with tank ⅔ full
- ★ Weight 22 lbs.
- ★ Overall Height 21"
- ★ Handle Length 20" overall. 17½" pipe handle
- ★ Mounted to suit customer requirements



- Forced lubrication and internal bleeding for axial balance and to eliminate high pressures against oil seals.
- Rotate in either direction.
- Heavy-duty roller bearings.
- Small cube space.
- 8, 17, 25 GPM at 1000 PSI
- Gear type, constant displacement.



- Large oil passages.
- Close grained, high tensile alloy body castings.
- 2 types of action.
- Spring centered, ball detent hold.
- Hardened ground spool.
- Precision honed valve body.
- Pressure relief valve.
- Hardened seat insert for long life.

Hein-Werner Corporation Waukesha, Wisconsin

HEIN-WERNER CORPORATION
WAUKESHA 4, WISCONSIN
Circle **68** *on Time-Saver Card*

POST SCRIPTS OF INDUSTRY

News about people, manufacturers and sales organizations

Three new district managers for Marsh Instrument

Marsh Instrument Company, Skokie, Ill. made these new appointments: Don L. Warner to district manager in the Philadelphia area. He will direct the company's new Philadelphia sales office and serve

Warner

Storrs

in eastern Pennsylvania, New Jersey, District of Columbia, Maryland and Delaware. James Kelly to midwestern district manager. Mansur Storrs to New England district manager. He will serve, from the company's Quincy offices, the states of Maine, Vermont, New Hampshire, Connecticut, Rhode Island and Massachusetts.

Rumsey promoted to district manager

Rumsey

Establishment of a Kansas City district office was announced by Ross Heat Exchanger Division, American-Standard. The new office at 5920 Nall Ave., Mission, Kas., will be managed by Don Rumsey. He was previously on the Chicago office staff.

Hydro-Line adds Pacific representatives

Arvis Engineering Ltd., New Westminster, B.C. covering British Columbia; Northern Hydraulic Services Ltd., Edmonton, Alberta, covering Alberta and Saskatchewan; and Teglen Engineering, Los Angeles, Calif., for the Southern California area, have been appointed by Hydro-Line Manufacturing Co., Rockford, Ill.

Two distributors added by Rivett Lathe

Rivett Lathe & Grinder, Inc., Boston, Mass., has appointed Stanley Berg, Inc., Pittsburgh, Pa., as distributor in Western Pennsylvania. The Scott Equipment Co., Wheeling, W. Va., has been named West Virginia and Southeastern Ohio distributors.

Pittman is manager for Modernair operations

Pittman

Glen R. Pittman has been named Eastern Operations Manager for Modernair Corp., San Leandro, Calif. He was formerly sales manager of the Hydraulic Power Division of Hydraulic Press Mfg. Co., a Koehring Co. Division. Temporary headquarters for Pittman is Mt. Gilead, Ohio.

Lexington plant purchased by Parker

A plant in Lexington, Ky., has been purchased by Parker-Hannifin Corp., Cleveland, Ohio. According to President Paul F. Smith, Parker Seal Co. Division, the new property will help supply the rapidly-developing eastern market for combination metal and rubber seals, now produced almost exclusively in Culver City, Calif.

Continued on page 158

Circle **97** on Time-Saver Card

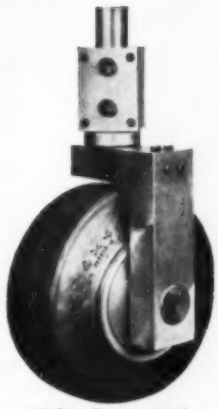
TOG-OIL®
Double-Acting, Toggle Linkage HAND PUMPS

- Variable Leverage Ratio up to 3.5:1
- Models for 1000, 3000, and 10,000 P.S.I.

HYDRO-WHEEL®
Makes Platform Lifts SELF-PROPELLED

- Gives 360° Steering
- Simple, Safe, Easy-to-Install

► **Rotary Pumps**
► **Needle Valves**
► **4 and 5 Way Valves**



Write Dept. AP-3

MECHANISMS CO. 118 E. 2nd St. Uhrichsville, Ohio

Circle **131** on Time-Saver Card

If your equipment or process requires . . .

ACCURATE, AUTOMATIC TEMPERATURE CONTROL

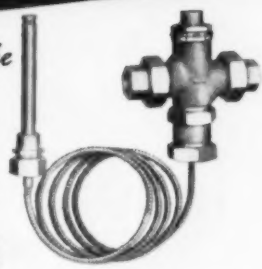
for HEATING or COOLING (using STEAM, WATER, or HEAT TRANSFER FLUIDS)

There is no equal to the

Sterlco®

Series 150-E

TEMPERATURE CONTROL VALVE



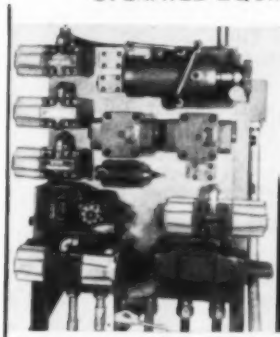
Here is a quality, dependable, and low cost self-actuated automatic modulating control valve. It's compact, self-contained; and, as part of your equipment or process, will eliminate the human factor of manual valves. Balanced single-seated construction eliminates effect of pressure variation. Send for Bulletin #505.

MOUNTS *and* OPERATES *in* ANY POSITION

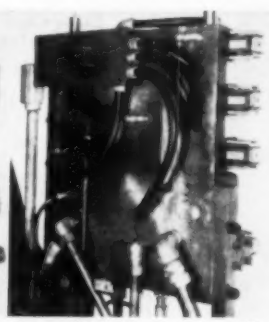
INDUSTRIAL CONTROL DIVISION
STERLING, INC.
5202 W. Clinton Ave. • Milwaukee 18, Wis.

HOW MACHINE TOOLS, POWER UNITS AND OTHER HYDRAULICALLY OPERATED EQUIPMENT CAN BE IMPROVED IN DESIGN BY THE USE OF—

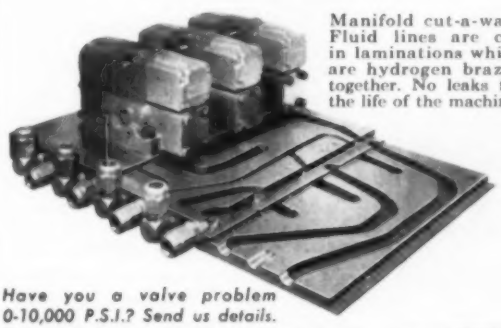
ALMO MANIFOLDS



Front of panel — Valves and controls located in orderly fashion. Fluid lines are machined in panel.



Rear of panel — Note take-offs directly to motors and cylinders. Electric junction box also mounts on manifold



Manifold cut-a-way. Fluid lines are cut in laminations which are hydrogen brazed together. No leaks for the life of the machine.

Have you a valve problem 0-10,000 P.S.I.? Send us details.

1 Faster, less costly installation. All interconnecting of valves and controls is prefabricated into the panel (manifold). Result is important labor savings in manufacture and installation.

2 Less service and maintenance. Exposed tubing and piping means failures due to accidental blows and vibration. Leaks are costly to locate and repair because they mean machine down-time.

3 Better engineered. Like a printed radio circuit, Almo manifolds eliminate trial and error assembly. The machine will operate when it is installed because the circuit is the way you engineered it.

4 Better appearance. An orderly panel with valves and controls conveniently mounted and the "spaghetti" eliminated makes your product not only perform better but look better.

Invitation to failure. Exposed lines are no longer necessary.

Any size — Any number of circuits

Write for brochure

ALMO TOOL COMPANY
11470 Kaltz — Centerline, Mich.

Circle **11** on Time-Saver Card

POST SCRIPTS OF INDUSTRY

Murray, Case fill posts in Worthington department

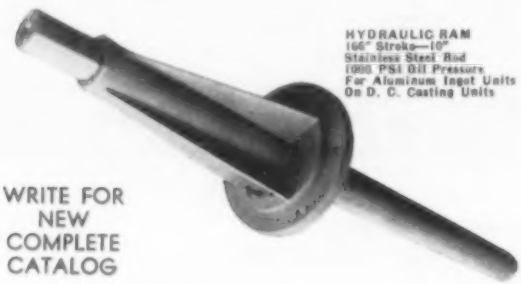
E. A. Murray has been chosen manager of the newly-combined Sales & Service Dept. at the Compressor & Engine Division of the Worthington Corp., Buffalo, N. Y. Everett L. Case replaces Murray, moving from assistant to manager of compressor sales. With Worthington since 1937, Case held his former job since 1954. Murray joined the company in 1935.

Rizzolo is now controller

Carl V. Rizzolo, Jr., has been promoted to the newly-created position of controller for The Airoyal Co., Maplewood, N. J. Rizzolo will continue with his duties as office manager.

Lincoln AIR AND HYDRAULIC Cylinders

The answer to the increased demand for rugged, heavy duty air and hydraulic cylinders. Designed for the hardest usage in Steel Mill operation or for the hundreds of other modern cylinder applications that require dependable efficient service.



HYDRAULIC RAM
166" Stroke—10"
Stainless Steel Rod
1000 PSI Oil Pressure
For Aluminum Ingot Units
On D. C. Casting Units

WRITE FOR NEW COMPLETE CATALOG

HYDRAULIC CYLINDER
12" Bore—24" Stroke
2000 PSI Oil Pressure
Lifting Capacity Equals
1,000,000 lbs.
For Oil Shale Retorts.

JACK CYLINDERS
For Mining Operation
10" Bore—140" Stroke
2000 PSI Oil Pressure

Lincoln MACHINE CO. INC.

P. O. Box 272 EDgewood 2-4689 Salem, Ohio

Houghton makes three staff changes

Eismann

William Eismann, Jr., was appointed manager of national lubrication sales for E. F. Houghton & Co., Philadelphia. In 1956 he became assistant to the research manager. For the past 10 years Eismann served as Houghton's chief research liaison on government and military contracts. Promoted to assistant managers of research were Dr. Ellis Abrams and Paul J. Welsh. Dr. Abrams, former supervisor of organic research, was made supervisor of textile, paper, and organic research. Previously manager of product development, Welsh takes charge of research in metal working, rust preventives, and lubrication.

Ormsby fills new post

Perry F. Ormsby was named to fill the newly-created post of vice president in charge of manufacturing for Teer, Wickwire and Co., Jackson, Mich. Ormsby, with the company since 1956, was manufacturing manager.

Superior Tube creates two sales positions

In order to expand its nation-wide sales program, Superior Tube Co., Norristown, Pa., appointed William C. Hanna field sales manager and

Hanna

Huston

Lloyd M. Huston sales-service manager. Hanna, with Superior since 1935, was midwestern resident representative located in Chicago. Huston was previously head of the company's internal services.

Expansion objective achieved by U. S. Gauge

Construction of a modern, straight-line plant has achieved a two-fold objective of United States Gauge,

a division of American Machine and Metals, Inc. The objective was to provide more economical mass production and additional space for new product development. This facility at Sellersville, Pa., permits consolidation of all mass gauge production under one roof. At the same time, substantial space is freed in older buildings for greater emphasis on high-precision instrumentation controls.

Van Schwartz joins Norgren

Van Schwartz

Zolly C. Van Schwartz has been made technical consultant for the C. A. Norgren Co., Englewood, Colo., and its subsidiary, Norgren-Stemac, Inc. Prior to joining Norgren, Van Schwartz was director of engineering standards for the Baldwin-Lima-Hamilton Corp. for 12 years.

Bell, Archer join Greer Hydraulics' staff

Bell

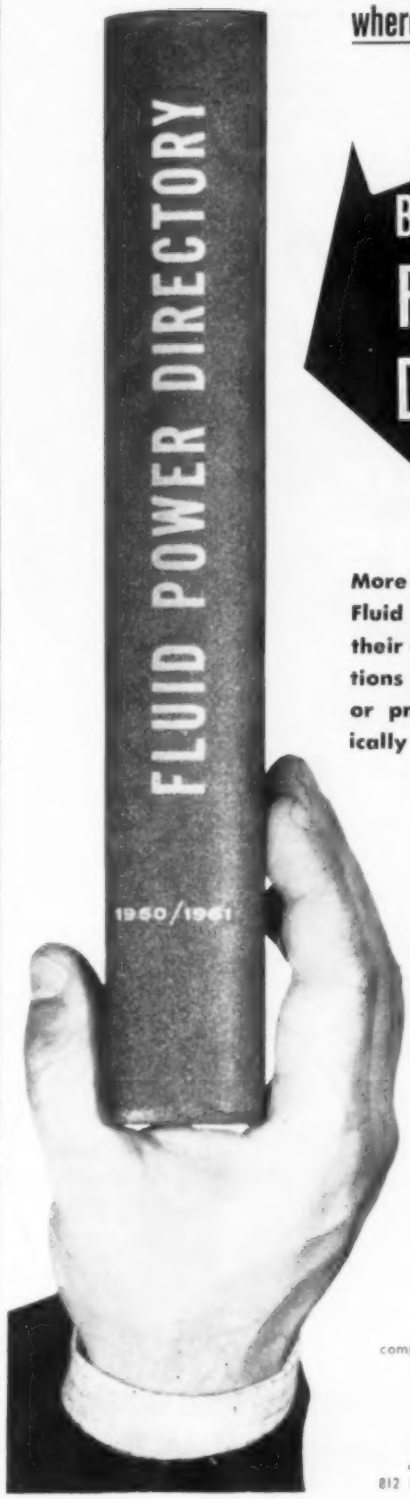
Dr. Ronald Bell and Robert Archer have joined Greer Hydraulics, Jamaica, N. Y. Dr. Bell, formerly associated with the Bell System Westrex Division, is a senior research physicist. Archer, a member of the N. Y. State University's Technical and Agricultural Institute, is a development engineer.

Parker-Hannifin adds two new distributors

Two new distributors have been added by the Parker-Hannifin Corp., Cleveland, Ohio. The W. E. Thew Supply Co., Inc., 339 South Broadway, Green Bay, Wis., will handle the company's products and will be supplied by W. E. Anderson of Milwaukee. The R. C. Hazleton Co., Portland, Me., is now stocking reusable Hoze-lok fittings and industrial hose. It will be serviced by Herb H. Walley, New England district manager.

Continued on page 160

will it fit our circuit?
who makes it?
what size does it come in?
where can I buy it?



Better check the Fluid Power DIRECTORY

More than 65,000 engineers keep the Fluid Power Directory handy. It's their quick reference to the 101 questions that pop up during a hydraulic or pneumatic circuit design. Specifically they check the Directory for:

- ***CATALOG DATA*** **— condensed specs on more than 150 manufacturers' products.**
- ***TRADE NAMES*** **— cross referenced to makers.**
- ***DIRECTORY*** **—who makes what for hydraulic and pneumatic systems: over 150 product groups, more than 800 manufacturers listed for easy reference.**
- ***DESIGN MANUAL*** **— circuits, nomographs, designs and applications: a complete handbook for industrial, mobile and aviation systems.**
- ***LOCAL SOURCES*** **— an index to local outlets for speedy supplier selection.**

Now in preparation: **the 1960/61 Fluid Power Directory**
Publication date: **October 28, 1959**

Closing date for advertising: **July 24, 1959**

compiled by the editors of

APPLIED **Hydraulics & Pneumatics**

an industrial Publishing Corporation magazine
812 Huron Rd. • Cleveland 15, Ohio

POST SCRIPTS OF INDUSTRY

Miller fills new post at Racine Hydraulics

George B. Miller has been appointed to the new post of vice president in charge of operations of Racine Hydraulics & Machinery, Inc., Racine, Wis. Miller, who joined Racine in 1940, had been chief engineer since 1946, vice president of engineering since 1955. He is also director of Simplex Engineering Co., a Racine subsidiary at Zanesville, Ohio.

Bailey appointed general manager

Richard J. Bailey has been appointed general manager of the high-pressure pneumatics division of Airdox Cardox Products., Chicago. He was associated with Cardox Corp., a part of the newly-named company.

Capital

HYDRAULIC FILTERS

for Hydraulic and Oil Re-circulating Machinery

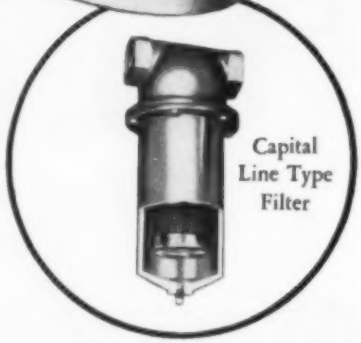
Capital Hydraulic Filter Units are smaller than ordinary filters but with filtering capacity equal or superior to many larger filters. Small size permits greater latitude in design, particularly where space is restricted.

Capital Filter Units are designed with one-piece construction — no screws or nuts to work loose and be lost or mislaid. Simple and easy to clean by any method.

Made from specially designed woven Monel wire, with narrow corrugations presenting the greatest filtering area. Monel support supplies extra sturdiness.

Capital Filter Units are made in 4 Types:

- **MONO-BILT 60 Mesh All Stainless Steel (Sump type).**
- **MONO-BILT Standard All Stainless Steel**
- **MONO-ECONO Mono-Bilt with Monel Metal Insert and Cadmium Plated Top and Bottom.**
- **LINE TYPE with Aluminum Housing and Mono-Bilt, one Piece Filter Unit.**



Capital Line Type Filter

Built from Monel Metal they are impervious to rust and corrosion.

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Kobe appoints industrial sales representative

Prigge

William C. Prigge has been named western district sales representative for Kobe, Inc.'s expanding industrial sales organization. Prigge joined the company in 1946 as a technical service representative of the firm's hydraulic oil well pumping system. He will work out of the Huntington Park, California plant.

Sales-engineering office for Electrosnap

To serve metropolitan New York, Electrosnap Corp., Chicago, Ill., has opened an office at 30 Cranberry Lane, Bethpage, L. I. This new operation will be managed by Kacil Brin, who has worked for the past year as a sales engineer in the New York territory. He joined Electrosnap in 1954 as a project engineer.

Two appointed managers at Weatherhead

Two men were appointed to managerial positions at the Fort Wayne, Ind., Division of The Weatherhead Co. William A. Hertel, with the company since 1939, was made manager

Hertel

Foote

of government sales and engineering, a promotion from engineering manager. Charles Foote was made manager of the product engineering section. He has been with Weatherhead since 1945 and with the Fort Wayne division since it opened in 1955.

Three sales representatives named by Nopak Division

New sales representatives for central and southern Indiana for the Nopak Division of the Galland-Henning Mfg. Co., Milwaukee, Wis.,

is the Industrial Air Equipment Co., Indianapolis. Other appointments include B. L. Montague Co., Inc., Sumter, for South Carolina, and Industrial Electric Co., Nashville, for Tennessee.

Norris new president of Denison Engineering

Norris

Paul W. Norris has been named president of Denison Engineering Division, American Brake Shoe, Co., Columbus, Ohio. With Denison 25 years, he was vice president and general manager since 1957. Norris served as director of sales and a vice president from 1953 until named to his former position.

Four sales changes made by Republic

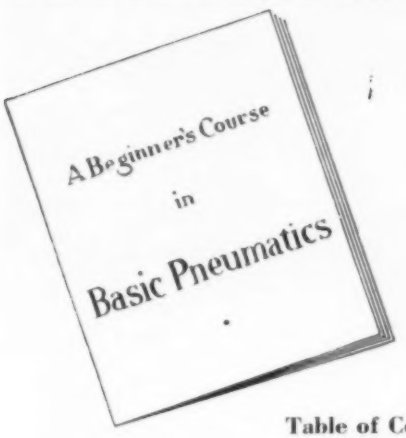
Four sales territory changes were made by Republic Manufacturing Co., Cleveland, Ohio. George A. Harrison has been transferred to the midwest, covering Ohio, Kentucky, West Virginia, and Western Pennsylvania. Cliff V. Ostle will cover Michigan and Canada. Howard G. Fitzpatrick will cover New England in addition to his Metropolitan New York territory. Stanley L. Burg will cover Western New York and Erie County, Pennsylvania.

Skinner announces two management appointments

Bloudek

Two changes were made in the Electric Valve Division of The Skinner Chuck Co., New Britain, Conn. William J. Bloudek, for 10 years a sales engineer in the company's Mid-West office, was named sales manager. Anders Anderson, named as sales office manager, will be in charge of internal sales, quotations, procedures, deliveries and customer service. He has been with Skinner since 1953.

Continued on next page



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First printed in July 1954, 5000 copies of this popular booklet were bought by more than 800 companies and individuals. A second printing makes this course available to you.

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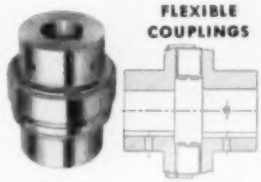

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Bores (max.).....⅝" to 9½"
O.D. .....⅜" to 21½"
Wt. .....½ oz. to 1500 lb.
H.P. .....1/20 to 4250
Torque (static).1½ to 5100 ft.-lbs.

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VARIABLE SPEED PULLEYS

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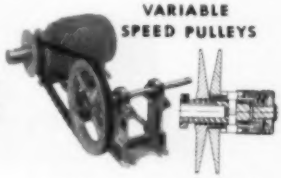

Bores (max.).....½" to 1⅝"
O.D. .....3" to 13⅜"
Belt Sizes.....A to 2¾ TW
Speed Ratios.....1-1 to 8-1
H.P. (1750 rpm).....¼ to 15

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UNIVERSAL JOINTS

Request Bulletin 820

Bores.....¼" to 2"
Hub Dia. .....½" to 4"
Static Torque 340 to 130700 in.-lbs.
H.P. (100 rpm.).....½ to 207

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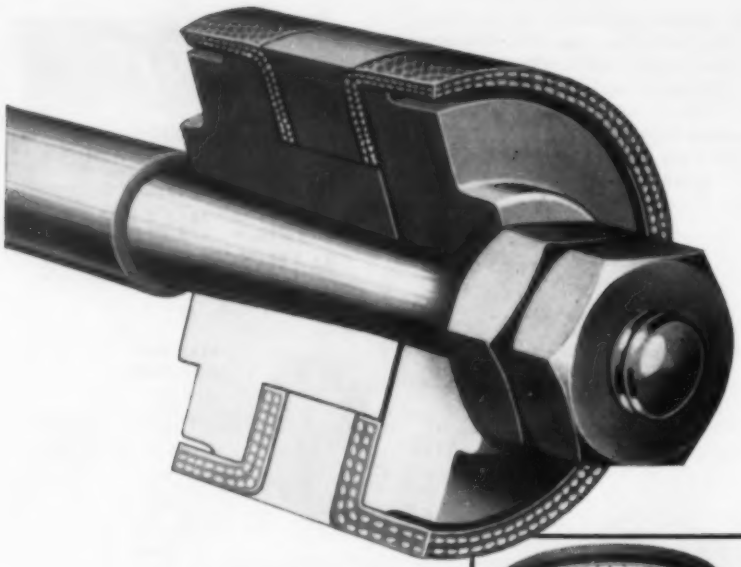

WHY PUMCUPS MAKE A DIFFERENCE

Darcova Pumcup

Darcova 45° Bevel Type Pumcup

- **in reciprocating pumps**
- **in air and hydraulic cylinders**

With Darcova Pumcups in your cylinders, there's less fluid slippage. High volumetric efficiency is maintained and Pumcups outlast other packings at least 3 to 1! There's less down-time! Lower power cost! Smoother operation! Less maintenance and replacement!

Longer life is the result of truly advanced cup engineering, including 100% nylon composition, plus a choice of types, textures and precision sizes to exactly match fluid, cylinder, pressure and temperature conditions.

These same factors contribute to prolonged high efficiency by permitting full advantage of the "cup principle". Thus fluid pressure always keeps Pumcups snug against cylinder wall, despite eventual wear, while the total frictional load is minimized.

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Williamsport 15, Pa.

DARCOVA — THE ORIGINAL COMPOSITION CUP

TRADE MARK PUMCUPS

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POST SCRIPTS OF INDUSTRY

Promote three at Parker

Promotion of Paul F. Smith from general manager to president of Parker Seal Division, Culver City, Calif., headlined three recent personnel changes. Scott A. Rogers, assistant general manager, became vice president, and T. J. McCuistion, sales manager, was made sales vice president.

Garlock names Waples as new board chairman

New board chairman at The Garlock Packing Co., Palmyra, N. Y., is Robert M. Waples, an employe since 1915. Replacing

Waples

McMullen

Waples as president is a former vice-president, A. J. McMullen. He was president of the U.S. Gasket Co. from 1942-1955 when it was acquired by Garlock. Waples was president since 1955. He succeeds George L. Abbott as chairman.

New distributor appointments

The Rains Co., Salt Lake City, Utah, is the stocking representative for its state for Skinner Electric Valve Division, New Britain, Conn.

Lynn McGuffy Co., Inc., Shreveport, La., will represent the Industrial Silencer Division of Burgess-Manning Co., Libertyville, Ill., in Southern Arkansas, North Louisiana, and Northern Mississippi.

Colliflower, Inc., Endicott City, Maryland, as representatives in Maryland and Virginia; and A. F. Woolsey, Seattle, Washington, as representative in Washington, Oregon and Idaho, for Petch Manufacturing Co.

Air Associates, Dallas branch, is now a stocking distributor of Republic Mfg. Co.'s valves.

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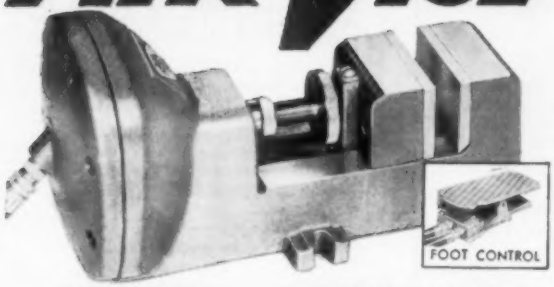
Speedy AIR VISE



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SPEEDY AIR REGULATOR
Regulates pressures 0 to 140 lbs. No. 622 **$7.25**

SPEEDY AIR FILTER
Assures clean, oil-free air. No. 140 **$4.00**

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Production spray unit with Ext. Mix Gun. No. 705 **$26.50**

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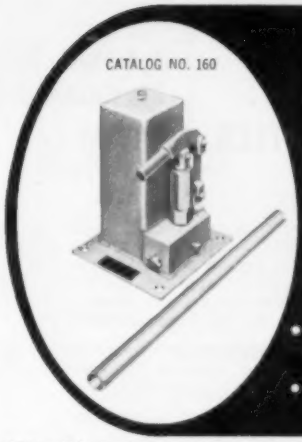

Hand Hydraulic Pumps

- Single and Double Designs to 20,000 psi
- With or Without Reservoir

160 cubic inch reservoir with 8"x 8" base plate and 18" long handle.

Available with optional size pistons ⅜", ½", ¾", 1" and 1½".

We specialize in the manufacture of hand pump units which operate in temperatures from −65° F. to +160° F. and with any capacity reservoirs required. Pumps can be furnished on special order with custom seals to handle various aircraft types of fuels such as Pydraul, Skydrol, Oronite, etc.

The single pump with ½", ¾", 1" or 1½" piston is now available in stainless steel.

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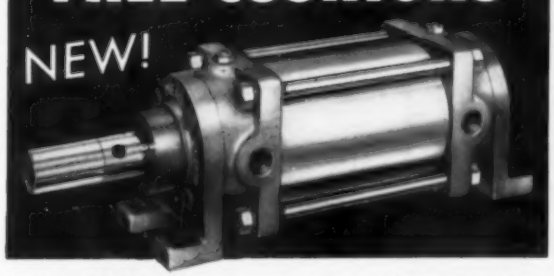

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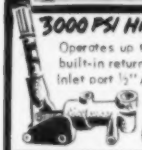
3000 PSI HAND PUMP



Operates up to 3000 PSI. Has a built-in return flow check valve. Inlet port ½" AN, outlet 1/4" AN. No. HP-30 **Only 22.50**

1500 PSI Hydraulic HAND PUMP Displaces 0.19 GPM at 30 cycles per min. Capacity 1.5 cu. in. per cycle. No. HP-3U **6.88**

NEW HEAVY DUTY SLIDING PISTON 4-WAY VALVE

Available in Open or Closed Center. 3000 PSI type available with spring return or detents. 2000 PSI type has spring return to neutral. Specify type needed. Both have built-in adjustable relief valve. Maximum flow is 10 GPM. Order either 2000 or 3000 PSI type. SAVE at our LOW PRICES!

2000 PSI type $24.50
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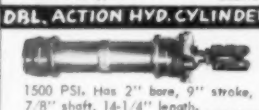
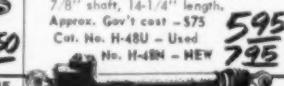
STRATO POWER HYD. PUMP

Delivers 10 gal. per minute at 1500 RPM at 3000 PSI. Pressure is adjustable from 2800 to 3800 PSI. A variable displacement, piston type. Displaces 1.694 cubic in. per revolution. **99.50**

DBL. ACTION HYD. CYLINDER



1500 PSI. Has 2" bore, 9" stroke, 7/8" shaft, 14-1/4" length. Approx. Gov't cost – $75
Cat. No. H-48U – Used **5.95**
No. H-48N – NEW **7.95**



Ideal for clutch or throttle control when used as a master & slave. Bore 5/8", stroke 4-1/8", shaft 7/16", length 9-5/8". Parts 1/4" tube. NEW. Cat. No. H-60 **3.75**

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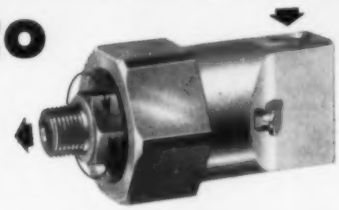

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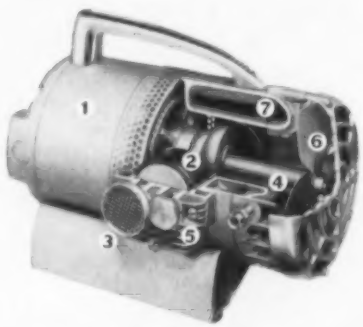

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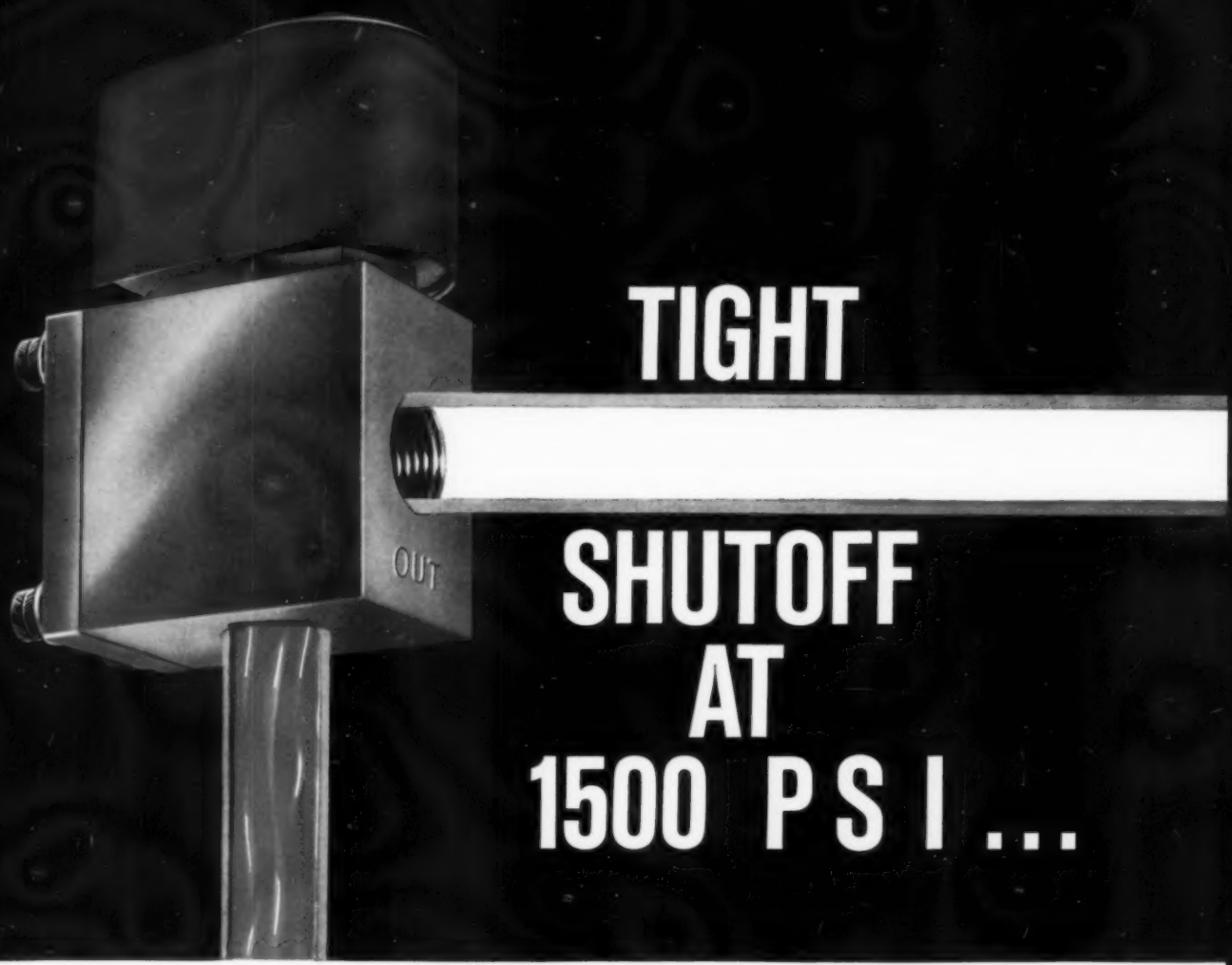

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